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HEALTH AND SAFETY PLAN FOR PROJECT OPERATIONS SITE INVESTIGATION AND REMEDIAL INVESTIGATIONS VOLUME II OF II NTC ORLANDO FL
8/1/1997
ABB ENVIRONMENTAL SERVICES, INC

HEALTH AND SAFETY PLAN

PROJECT OPERATIONS PLAN FOR SITE INVESTIGATIONS AND REMEDIAL INVESTIGATIONS

VOLUME II OF II

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

Unit Identification Code: N65928

Contract No. N62467-89-D-0317/107

Prepared by:

ABB Environmental Services, Inc.
2590 Executive Center Circle, East
Tallahassee, Florida 32301

Prepared for:

Department of the Navy, Southern Division
Naval Facilities Engineering Command
2155 Eagle Drive
North Charleston, South Carolina 29418

Barbara Nwokike, Code 1873, Remedial Project Manager

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GLOSSARY

ABB-ES	ABB Environmental Services, Inc.
BRAC	Base Realignment and Closure
CFR	Code of Federal Regulations
CHRIS	Chemical Hazards Response Information System
CLEAN	Comprehensive Long-term Environmental Action, Navy
CPR	cardiopulmonary resuscitation
CPT	cone penetrometer testing
CRZ	Contamination Reduction Zone
DCE	dichloroethene
DDT	dichlorodiphenyltrichloroethane
DPDO	Defense Property Disposal Office
EBS	Environmental Baseline Survey
FID	flame ionization detector
FOL	Field Operations Leader
GM	Geiger Mueller
HASP	Health and Safety Plan
HCS	Hazard Communication Standard
HNu	HNu, Inc., Manufacturer of Photoionization Detector
HSM	Health and Safety Manager
HSO	Health and Safety Officer
IDLH	Immediately Dangerous to Life and Health
LEL	lower explosive limit
MSA	Mine Safety Associates
MSDS	material safety data sheets
msl	mean sea level
NTC	Naval Training Center
O_2	oxygen
OSHA	Occupational Safety and Health Administration
OVA	organic vapor analyzer
PCBs	polychlorinated biphenyls
PCE	tetrachloroethene
PID	photoionization detector

GLOSSARY (Continued)

POI	point of interest
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
TCE	trichloroethene
TIP	total ionizables present
TLD	thermoluminescent dosimetry
TOM	Task Order Manager
USCG	U.S. Coast Guard
USDOT	U.S. Department of Transportation
USEPA	U.S. Environmental Protection Agency
UXO	unexploded ordnance
WWTP	wastewater treatment plant

1.0 GENERAL

1.1 SCOPE AND PURPOSE. This Health and Safety Plan (HASP) has been prepared in conformance with the ABB Environmental Services, Inc. (ABB-ES), Health and Safety Program and the Comprehensive Long-Term Environmental Action, Navy (CLEAN) District I Contract (CLEAN HASP) and is intended to meet the requirements of 29 Code of Federal Regulation (CFR), Part 1910.120. As such, the HASP addresses those activities associated with field operations for this project. Compliance with this HASP is required for all ABB-ES personnel, contractor personnel, or third parties entering any site at Naval Training Center (NTC), Orlando.

The NTC, Orlando HASP contains some general site information, ABB-ES standard operating procedures, and health and safety guidance included as appendices to this document. A copy of this reference HASP will be available at each work location. Site-specific HASP addenda will be generated, using the format included as Attachment A, that describe the activities, potential hazards, precautions, and action levels associated with tasks performed at specific study areas or other points of interest at NTC, Orlando.

1.2 PERSONNEL. The following project personnel have specific health and safety responsibilities as outlined below. Refer to Appendix A for additional information regarding health and safety roles and responsibilities. Key personnel for each site-specific investigation will be identified in the HASP addenda.

1.2.1 Contractor Task Order Manager The contractor Task Order Manager (TOM) for Base Realignment and Closure (BRAC) activities at NTC, Orlando is Mr. John Kaiser. TOM responsibilities for specific tasks may be assigned to other project team individuals, as necessary. The TOM is the individual with overall project management responsibilities. Those responsibilities as they relate to health and safety include provision for the development of this site-specific HASP, organizing the necessary resources to meet requirements of this HASP, coordination of staff assignments to ensure that personnel assigned to the project meet medical and training requirements, and obtaining the means and materials necessary to resolve any health and safety issues that are identified or that develop on the project.

1.2.2 Health and Safety Manager The Health and Safety Manager (HSM) for ABB-ES, Ms. Cynthia Sundquist, may be reached at (207) 775-5401, extension 3309, in Portland, Maine. The HSM will be responsible for (1) approval of the individual chosen to serve as the site Health and Safety Officer (HSO) for this field operation; (2) review and approval of the site HASP developed by the HSO, as well as any significant changes made over time to the site HASP; (3) oversight of the daily efforts of the HSO; (4) resolution of site disputes involving health and safety issues; and (5) implementation of the HASP by the HSO.

1.2.3 Field Operations Leader The Field Operations Leader (FOL) is the TOMs designee who is onsite and is vested with the authority by the TOM to carry out day-to-day site operations, including interfacing with the NTC, Orlando HSO.

1.2.4 Health and Safety Officer The HSO for this project has been designated by the TOM with concurrence from the HSM. The HSO will have at least an indirect line of reporting to the HSM for the duration of his/her assignment as project

HSO. The HSO is responsible for developing and implementing this site-specific HASP in accordance with the ABB-ES Health and Safety Program. The HSO will investigate all accidents, illnesses, and incidents occurring onsite. The HSO will also conduct safety briefings and site-specific training for onsite personnel. As necessary, the HSO will accompany all U.S. Environmental Protection Agency (USEPA), Occupational Safety and Health Administration (OSHA), or other governmental agency personnel visiting an ABB-ES site in response to health and safety issues. The HSO, in consultation with the HSM, is responsible for updating and modifying this HASP as site or environmental conditions change.

An individual must have a minimum number of days of field experience (for the appropriate levels of protection [i.e., D, C, and B]) and be current in first aid (certification within the last 3 years) and cardiopulmonary resuscitation (CPR) (certification within the last year) training to be eligible for the position of HSO.

1.3 TRAINING. Training is defined under the ABB-ES Health and Safety Program, and all personnel entering potentially contaminated areas of this site must meet the requirements of 29 CFR 1910.120. Personnel without the required training **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., in the exclusion zone). Refer to Appendix B for further information.

1.4 MEDICAL SURVEILLANCE. All personnel entering potentially contaminated areas of this site will be medically qualified for site assignment through a medical surveillance program outlined in the ABB-ES Health and Safety Program. Personnel who have not received medical clearance **will not be permitted** in any area with potential for exposure to toxic substances or harmful physical agents (i.e., in the exclusion zone). Refer to Appendix C for further information.

1.5 DOCUMENTATION. A daily health and safety log will be maintained by the HSO. This log will include, at a minimum, the following information: a description of the fieldwork being conducted, any changes in the operation, names of all personnel working at the site, types of air monitoring equipment being used and how it is calibrated, air monitoring results, level of personal protective equipment being worn, reports of accidents and injuries, and descriptions of any unusual occurrences of physical complaints.

1.6 HAZARD COMMUNICATION. In 1986, OSHA began enforcing the Hazard Communication Standard (HCS) (29 CFR 1910.1200). This standard requires employers to make their associates aware of the hazards to which they may be exposed. This standard does not apply to exposures to hazardous waste. Therefore, on hazardous waste sites, the only chemicals covered by the HCS are those ABB-ES or their subcontractors bring onto the site, such as for decontamination and sample preservation purposes. In 1987, when the Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) was first promulgated, most of the components of the HCS were incorporated into the new standard. Because of this, the only components of the HCS that need to be addressed separately at a hazardous waste site are labeling and material safety data sheets (MSDSs). The rest of the standard has been included in CFR 1910.120 or is part of the overall ABB-ES Health and Safety Program.

MSDSs for all chemicals brought to the site will be added to the MSDS section of the Health and Safety Plan and will be reviewed by all employees and subcontractors working at the site.

ABB-ES's policy has been to minimize chemical storage by purchasing small containers that are shipped directly to the site, so as to avoid the need to transfer bulk chemicals to smaller containers. (Note: The sample jars have been purchased with the preservative already added.) The original label will be kept on all containers. If the chemical needs to be transferred to a smaller container, the new container will be labeled with the name of the contents and appropriate hazard warnings (e.g., any combination of words, pictures, or symbols that conveys the chemical hazard; for example, the word "flammable" with a picture of a flame), if required.

Note: If the chemical has been transferred to a secondary container that is to be used that day by the person doing the transferring (e.g., total suspended particulate added to water for decontamination or methyl alcohol added to a squeeze bottle), labeling is not required. Some labeling may be used to distinguish the contents of a container if similar containers are used (e.g., "methyl alcohol" or "alcohol" written on the squeeze bottle to distinguish its contents from deionized water).

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE. NTC, Orlando (Figure 2-1) encompasses 2,072 acres in Orange County, Florida, and consists of four discrete facilities: the Main Base, McCoy Annex, Herndon Annex, and Area C.

The Main Base occupies approximately 1,095 acres within the city limits of Orlando and is located approximately 3 miles east of Interstate 4 and less than 1 mile north of State Road 50. Operations at the Main Base include the Recruit Training Command, Service School Command, Naval Administrative Command, Nuclear Power School, and the Naval Hospital (C.C. Johnson, 1985).

The facilities that comprise the McCoy Annex occupy 877 acres outside of the Orlando city limits and are located 12 miles south of the Main Base and just west of the Orlando International Airport. The Annex serves as a housing and community support activity for NTC, Orlando (C.C. Johnson, 1985).

Area C occupies an area of 46 acres, located 1 mile west of the main base off Maguire Boulevard, and serves as a supply center for NTC, Orlando (C.C. Johnson, 1985).

Herndon Annex occupies 54 acres and is situated 1.5 miles south of the Main Base, within the confines of the general aviation Herndon Public Airport. Herndon Annex provides research, design, development, testing, evaluation, procurement, fabrication, maintenance, and logistical support for naval training equipment and devices. Herndon Annex is composed of a computer center, flight-training building, uniform supply warehouse, and several office buildings (C.C. Johnson, 1985).

2.2 SITE HISTORY AND LAYOUT.

Main Base. The facilities at the Main Base were owned and operated by the Army Air Corps from 1940 to 1947 as the Orlando Air Base. The U.S. Air Force took command of the facilities during 1947, at which point it became the Orlando Air Force Base. The Air Photographic and Charter Service was the most active facility on the base and was responsible for photographic development of U.S. Air Force movies and still photographs. The property was commissioned as the Naval Training Center in 1968 when the U.S. Air Force ceased operations at the facility (ABB-ES, 1994).

The area of the Main Base varies in elevation from approximately 125 feet above mean sea level (msl) at the Recruit Training Command (C.C. Johnson, 1985) to approximately 91 feet above msl at Lake Baldwin. Surface water runoff from this area flows through small intermittent streams and the storm drainage system to Lake Susannah and Lake Baldwin, and eventually to the Little Econlockhatchee River. Both of these lakes are used for fishing and recreation and are Class III waters according to the State of Florida (ABB-ES, 1994).

The Main Base occupies approximately 1,095 acres within the Orlando city limits and is composed mainly of operational and training facilities used for training new recruits. The land use is primarily barracks, training facilities, administrative buildings, drill fields, and recreational areas.

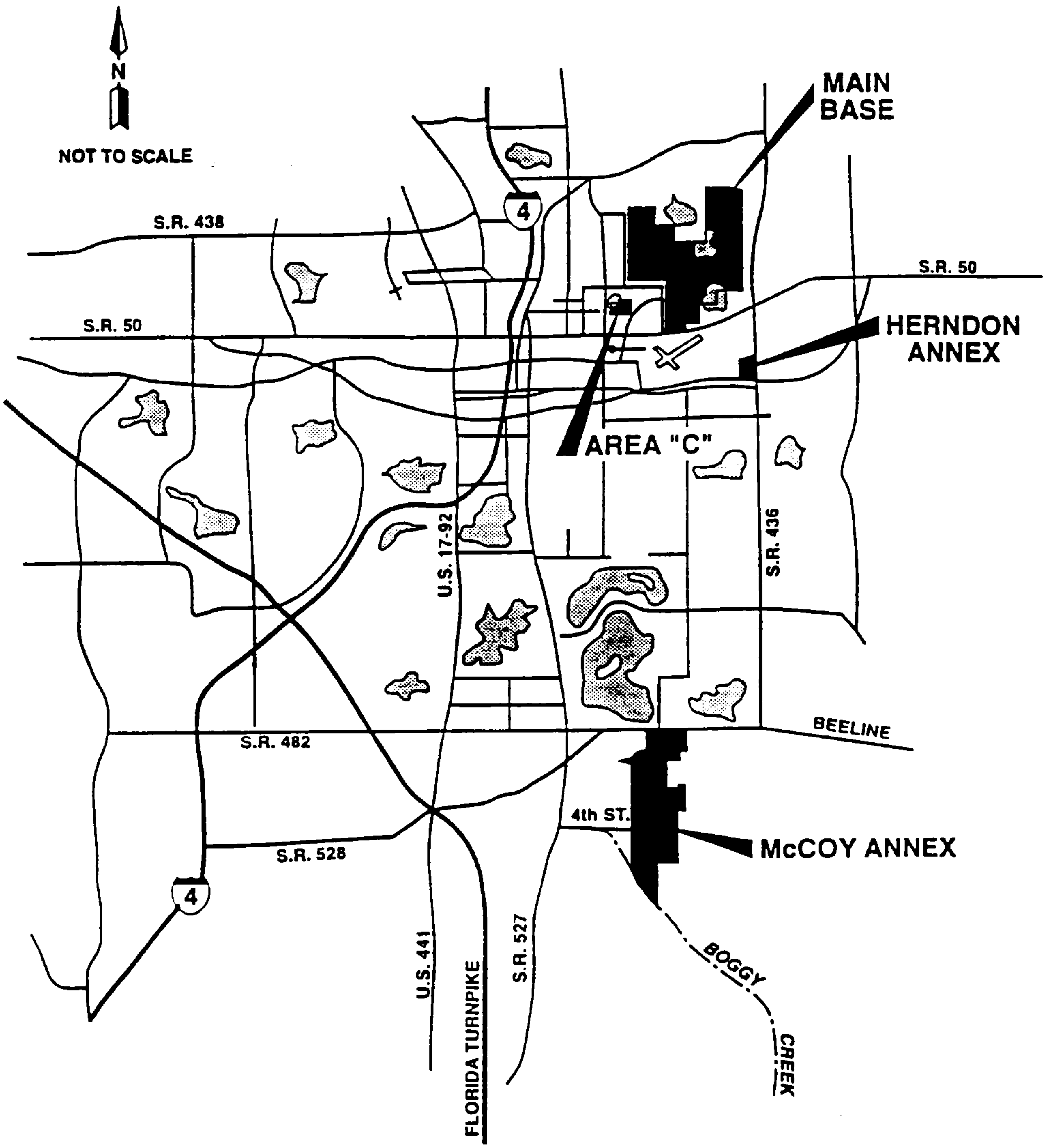

FIGURE 2-1

VICINITY MAP

PROJECT OPERATIONS PLAN, HEALTH AND SAFETY PLAN

NAVAL TRAINING CENTER
ORLANDO, FLORIDA

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The area surrounding the Main Base is primarily residential with a commercially zoned area adjacent to the residential areas. There are two lakes within the Main Base property (Lakes Baldwin and Susannah) and four lakes (Spier, Forest, Shannon, and Gear) located in the residential areas adjacent to the facility (C.C. Johnson, 1985).

<u>McCoy Annex</u>. The McCoy Annex was originally owned and operated from 1950 to the late 1950s by the U.S. Air Force Strategic Air Command as the Pinecastle Air Force Base. It then became the McCoy Air Force Base from the late 1950's to 1974 when NTC, Orlando acquired the facility and renamed it the McCoy Annex (C.C. Johnson, 1985).

The land at McCoy Annex is essentially flat and gently sloping from north to south with little change in grade. The elevation is approximately 90 feet above msl and surface water flows south into the Boggy Creek Drainage Basin approximately 4 miles south of the Annex (C.C. Johnson, 1985). Surface water from Boggy Creek then flows east into Lake Tohopekaliga, which is approximately 12.5 miles south of the Annex.

The McCoy Annex occupies 877 acres outside the Orlando city limits and is located adjacent to Orlando International Airport on the east. There are two elementary schools located within a mile of the Annex on the west boundary, and most of the area immediately adjacent to the Annex to the west is vacant wooded area. The Beeline Expressway forms the northern boundary. The property north of this expressway is used primarily for airport-related industry. Adjacent to the southern boundary are undeveloped woodlands. Land use at McCoy Annex is primarily housing and recreation (golf course) with limited operational facilities (C.C. Johnson, 1985).

<u>Area C</u>. Area C was constructed in 1942 to provide support services for the Army Air Corps Orlando Air Base and consists of a laundry facility, supply storage, and the Defense Property Disposal Office (DPDO) facility. The laundry facility has been operated for military use since 1942. From 1942 to 1957, the supply storage warehouses and salvage yard received military supplies and salvage-able material transported there by a railroad system. Since 1957, all materials have been shipped to Area C for storage via truck. In 1959, the DPDO took over operation of the salvage yard. The laundry facility, supply storage warehouses, and the DPDO have operated under the command of NTC, Orlando (ABB-ES, 1994).

Area C is surrounded by urban development and multifamily residences to the north (with single family residences across Lake Druid), single family residences to the south and west, and an office park to the east. There are no industrial facilities in the vicinity of Area C (C.C. Johnson, 1985).

<u>Herndon Annex</u>. Herndon Annex borders a major residential area and is adjacent to the Herndon airport (C.C. Johnson, 1985). The Herndon Annex land surface slopes from a high of approximately 120 feet msl at the southwest corner to its low point of about 93 feet msl at the northeast corner adjacent to Lake Barton. Surface water runoff flows into Lake Barton or to a closed depression with a small sinkhole lake located on the east side of the area (U.S. Geological Survey, 1980).

2.3 SCOPE OF WORK. Field investigations to be performed by ABB-ES will be designed to characterize soil, surface water, sediment, and groundwater conditions at the site. Tasks may include, but not be limited to, the following elements:

- geophysical surveys,
- test pit excavations,
- soil borings,
- monitoring well installations,
- soil gas sampling,
- soil and groundwater sampling,
- surface water and sediment sampling,
- water-level measurements and aquifer tests,
- TerraProbe℠ or cone penetrometer testing (CPT) investigations,
- unexploded ordnance (UXO) clearance surveys, and
- seismic refraction surveys (information regarding the handling and use of explosives is provided in Appendix Q).

Site-specific HASP addenda will be generated for each targeted area of investigation. These addenda will follow the format included as Attachment A to this HASP. If additional tasks are conducted at a target area, a new site-specific addenda may be generated or revisions may be made to the existing one. All information included in this general HASP is applicable to each individual investigation at NTC, Orlando.

2.4 HAZARD EVALUATION. ABB-ES has been tasked to conduct investigations at points of interest (POIs) identified in the Environmental Baseline Survey (EBS) of NTC, Orlando, conducted by ABB-ES (1996). The overall hazard level at NTC, Orlando is low. General health hazards and safety hazards associated with investigations at NTC, Orlando are presented in this section.

2.4.1 Health Hazards The potential health hazards associated with the POIs include inhalation or ingestion of and dermal contact with organic and inorganic chemicals that may be present in the subsurface soils and/or groundwater. Chemical Hazard Response Information System (CHRIS) data sheets for compounds detected or anticipated at NTC, Orlando are presented in Chapter 3.0.

Table 2-1 lists the current status of investigations and known or suspected contaminants of concern at NTC, Orlando. The primary hazards associated with several of the POIs are gasoline or other fuel-related compounds, organic compounds including aliphatic and chlorinated solvents, pesticides, explosive chemicals, landfilled biological waste (information on bloodborne pathogens is included in Appendix R), and radionuclides in the groundwater at the North Grinder and McCoy Annex landfills (information on ABB-ES's radiation protection program is included in Appendix U). Additional information on some of the common contaminants at NTC, Orlando follows.

Aromatic Hydrocarbons

Exposure to aromatic hydrocarbons can cause depression of the central nervous system, decreased alertness, headache, sleepiness, and loss of consciousness. If a dermal exposure exists, it can defat the skin, causing dermatitis. Benzene is the most toxic of the aromatic hydrocarbons in that it suppresses bone marrow function, causing blood changes. Chronic exposures can lead to leukemia. Aromatic

Table 2-1
Installation Restoration Program Non-UST/AST Investigation Synopsis*

Health and Safety Plan
Project Operations Plan for Site Investigations
and Remedial Investigations
Naval Training Center, Orlando, Florida

Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
1 GRP I	MB	1/White	3126	Hospital Civilian BEQ	Forty-square-foot stain on ground outside mechanical room.	No significant detections in soil or groundwater. One groundwater sample had a lead level of 17.1 µg/ℓ versus a Florida MCL of 15 µg/ℓ. The monitoring well was resampled on June 7, 1995, and no lead was detected. There was no evidence of landfilling operations. Property was approved for transfer by OPT 7/24/96.
		1/White	UNF-12	Alleged Hospital Landfill	Used as a landfill in the late 1970s, contents unknown.	
3 GRP I	MB	7/Gray	73/2817 2818	RTC 1st Lt. Storage	Hazardous materials are stored on the property and are regularly transferred to and from Building 2817. Former USAF Tactical Air Command operations involving Matador missile testing and personnel training.	PCE (tetrachloroethene) detections of 9 µg/ℓ and 12 µg/ℓ (versus Florida MCL of 3 µg/ℓ) were detected in groundwater samples. The two most recent rounds of sampling showed a decrease in PCE concentrations to 5.9 and 0.088 µg/ℓ, respectively, in the two monitoring wells. ABB-ES will sample groundwater over the next several months to monitor concentrations of volatile organic compounds. ***Report submitted for signature to OPT. Recommendations were to restrict groundwater use near well OLD-03-04 and to continue groundwater monitoring until MCLs were achieved and color could be changed to 4/Dark Green.***
4 GRP I	MB	4/Dark Green	250/8	Rusk Memorial Chapel and covered walkways	PCB spill of unknown quantity in the mid 1980s.	No significant detections in soil. No groundwater samples taken. Property was approved for transfer by OPT 7/24/96. Building 250/8 is 4/Dark Green and Building 251 is 1/White.
		1/White	251	Rusk Memorial Chapel Annex	PCB spill at adjoining property (Building 250) of unknown quantity.	
5 GRP I	MB	1/White	UNF-13	Septic Tank/Leachfield	Unknown environmental impacts from a previously existing motorboat maintenance facility and septic tank.	No significant detections in soil or groundwater. Geophysical surveys showed some buried pipes and/or metal objects. Property was approved for transfer by OPT 7/24/96.

See notes at end of table.

Table 2-1 (Continued)
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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
6 GRP I	MB	1/White		Lake Baldwin	Likelihood of contamination from stormwater runoff from golf course, photo lab, lead from former skeet range, drainage from firefighter training facility and motorboat maintenance facility, and alleged drum disposal in lake.	Surface water had no significant detections. Sediments had elevated levels of lead and 4,4'-DDE, though below the Florida probable effects level (PEL). One sample had elevated PAHs. Divers have investigated seven magnetic anomalies and observed various ferrous debris, but no items of environmental significance. Property was approved for transfer by OPT 7/24/96.
7 GRP I	MB	1/White		Lake Susannah	Receives stormwater runoff from other suspect areas and alleged drum disposal in lake.	Surface water had no significant detections. Sediments had elevated metals and PAHs, but below Florida PELs. The lake was approved for transfer by OPT 7/24/96.
8 GRP I	MB	6/Red	2134	Greenskeeper Storage	Likelihood of petroleum and pesticide spills.	Arsenic in surface soil and groundwater at Greenskeeper Storage Area will require further study; SA 9 has been designated as OU 3 ***(see listing for OU 3, page 1-32)***.
		3/Light Green	UNF-15	Former WWTP - Main Base	Burial of sludges from former WWTP and hospital demolition debris in WWTP lagoons.	Evidence of demolition debris buried under golf course. Gross alpha, Na, and Mn levels exceed screening criteria in three wells. Wells OLD-08-05 and -09 were resampled 12/29/95 due to elevated Mn (69.9 $\mu g/\ell$ versus FDEPG of 50 $\mu g/\ell$) and Na (248,000 $\mu g/\ell$ versus 160,000 $\mu g/\ell$). Mn/Na levels were measured at 97.4 and 59,800 $\mu g/\ell$. OLD-08-06 was resampled 6/17/96 for gross alpha, resulting in a gross alpha concentration of 0.39 pCi/ℓ versus 18.1 pCi/ℓ during the initial sampling. ***Property was approved for transfer in June 1997 with color change from 7/Gray to 3/Light Green.***
9 GRP I	MB	6/Red	UNF-14	Former Pesticide/Herbicide Storage	Pesticide and herbicide releases may have occurred during operation of facility.	Chlordane and arsenic in surface soil and groundwater will require further study; SA 8 (Greenskeeper Storage Area) has been designated as OU 3 ***(see listing for OU 3, page 1-32)***.

See notes at end of table.

Table 2-1 (Continued)
Installation Restoration Program Non-UST/AST Investigation Synopsis*

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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)

SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
[2]10 GRP I	MB	1/White	IAS-4	Former Yard Waste Disposal Area	Contents of disposal area unknown.	No significant detections in soil or groundwater. Property was approved for transfer by OPT 7/24/96.
27 GRP IV	MB	7/Gray	111	Visitors Pass Office	Evidence of cleaning solvent and paint product disposal in the retention pond.	Site-screening investigation completed in June 1996. Analytical results indicate that two surface soil samples had concentrations of BEHP or arsenic elevated slightly above residential screening levels but below industrial screening levels. A third sample had three PAHs with elevated concentrations. ABB-ES ***has completed supplemental investigation to delineate limits of PAHs in surface soils. Analytical results are forthcoming.***
		7/Gray	2010	Security Building		
		7/Gray	2073	Armory/Hurricane Storage Locker	Cleaning solution draining into retention pond.	
28 GRP IV	MB	7/Gray	114	Bowling/Arts & Crafts Center	Drip drying from silk-screen operation may have impacted the soil and/or groundwater.	Fieldwork ***began in June 1997.***
29 GRP IV	MB	7/Gray	127	Grounds Maintenance	Stained soil and stressed vegetation near a storage locker.	Fieldwork ***began in June 1997.***
30 GRP IV	MB	7/Gray	129	Automotive Hobby Shop	Waste oil storage and antifreeze-water separator.	Fieldwork ***began in June 1997.***
	MB	7/Gray	131	Paint Shop Materials Storage	Diesel fuel staining and stressed vegetation under an AST.	
		7/Gray	2262	Custodial Contractor	Past use as a pest control facility.	
31 GRP IV	MB	7/Gray	354	Nuclear Power Field "A" School	Impacts from UST and the oil-water separator.	Fieldwork ***began in June 1997.***
32 GRP IV	MB	7/Gray	358	BEQ/Heating Plant	Alleged dumping of paints, thinners, and petroleum products when this area was a motor pool.	Fieldwork ***began in June 1997.***
33 GRP IV	MB	7/Gray	2001	Administration Building	Dry well located on property.	Fieldwork ***began in June 1997.***
		7/Gray	2002	NTC Headquarters	Same as above.	
		7/Gray	2003	DFAS Office		
		7/Gray	2004	Administration Building	Stains on floor and walls of boiler shed and mechanical room, and a dry well located on the property.	

See notes at end of table.

Table 2-1 (Continued)
Installation Restoration Program Non-UST/AST Investigation Synopsis*

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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
34 GRP IV	MB	7/Gray	2024	NTC Supply	Unused supply well on site.	Appropriate well abandonment recommended for supply well. Fieldwork ***began in June 1997.***
35 GRP V	MB	7/Gray	2078	Auto Maintenance Facility	Soil staining associated with drum storage area.	The (final) work plan for Group V Screening was submitted to the Navy in September 1995. Fieldwork ***began in June 1997.***
		7/Gray	2079	Auto Maintenance Facility Storage	Unlabeled drum and unknown storage practices concerning the hazardous materials at the facility.	
36 GRP V	MB	7/Gray	2121	PW Lumber Storage	Soil staining from an oil spill, drum storage area.	Fieldwork ***began in June 1997.***
		7/Gray	2122	PW Shops	Suspect past and present storage and disposal of paints and solvents, solvents, and questionable oil collection practices.	
37 GRP V	MB	7/Gray	2414	Flammable hazardous waste storage	Possibility of thinner and solvent spills, unknown hazardous materials handling practices.	Fieldwork ***began in June 1997.***
38 GRP V	MB	7/Gray	4001	Storage and use of pesticides and herbicides	Extensive oil and fuel staining to the floor.	Fieldwork ***began in June 1997.***
39 AF SITES[5]	MB	7/Gray	4060	Loading Platform (Building 137)	Potential landfilling in this area.	Site-screening studies completed 4/96. Soil gas results indicate the presence of BTEX parameters and PCE. Lab results indicate exceedances in surface soil for benzo(a)pyrene (in 4 of 16 locations, 180J to 520 mg/kg) and arsenic (5 out of 16 locations, 1.1 to 6.7 mg/kg). Groundwater had minor exceedances for PCE (1 sample, 10 $\mu g/\ell$) and gross alpha and gross beta (1 gross alpha sample at 38.5 pCi/ℓ, 4 gross beta samples at up to 39.3 pCi/ℓ). Additional soil and groundwater resampling to evaluate RADs indicate very low activity levels in soil and below background levels in groundwater. Fieldwork to characterize PAHs/arsenic in surface soil complete, ***focused HHRA completed in April 1997. Field investigation to evaluate PCE in groundwater completed in May 1997. Report of findings scheduled for July 1997.***
		7/Gray	4067	Loading Platform (Building 137)	Potential landfilling in this area.	
		7/Gray	15109	Irrigation Well	In close proximity to the old coal storage area, out-of-service well on site.	
		7/Gray	UNF-10	Open Area (west of Nuclear Power School)	Unknown nature of coal staging area, west side of property allegedly used as a landfill.	

See notes at end of table.

Table 2-1 (Continued)
Installation Restoration Program Non-UST/AST Investigation Synopsis*

Health and Safety Plan
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Naval Training Center, Orlando, Florida

Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)

SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
40 AF SITES[5]	MB	7/Gray	21022	Softball Field	In close proximity to the bottle landfill (UNF-6) to the south, may be additional landfilling activities here.	Site-screening studies were completed in April 1996. Soil gas results indicate the presence of BTEX parameters and some PCE. Lab results indicate minor exceedances in surface soil from benzo(a)pyrene (200 J mg/kg) and arsenic (1.1 mg/kg); groundwater had minor exceedances for gross beta (31.8 pCi/ℓ). Additional soil and groundwater sampling indicates very low RAD activity in soil and below background RAD levels in groundwater. Fieldwork to characterize PAHs/arsenic in surface soil complete, ***focused HHRA completed April 1997. Report scheduled for August 1997.*** No indication of additional landfilling in this area.
		7/Gray	21023	Softball Field	In close proximity to the bottle landfill (UNF-6) to the southwest, may be additional landfilling activities here.	
		7/Gray	UNF-6	Bottle Landfill	Landfill with unknown contents.	
41 GRP V	MB	7/Gray	UNF-8	Open Area	Previous existence of buildings and storage tanks warrant further investigation.	Former USTs and/or ASTs will be evaluated in the Tank Management Plan (TMP). Site screening will evaluate potential PCB releases at former transformer sites. Fieldwork ***began in June 1997.***
42 GRP V	MB	7/Gray	2055	Maintenance Shop	Storage of hazardous materials, two filled-in sumps on site of unknown past use.	Fieldwork ***began in June 1997.***
43 AF SITES[5,6]	MB	1/White		North Grinder Landfill skeet range	Potential lead contamination.	Six surface soil samples (and 1 duplicate) collected and submitted for lead analysis in December 1995. No exceedances were noted.
	MB	3/Light Green	229	Indoor rifle and pistol range	Potential lead contamination. (See also Herndon Annex, Building 601)	Eighteen surface soil samples (and 2 duplicates) submitted for lead analysis 12/95. One sample slightly exceeded screening criteria. TCLP analysis for lead at the location of the highest lead concentration was below the RCRA regulatory limit, and lead is, therefore, not of environmental concern. This site was approved for transfer on 12/10/96.

See notes at end of table.

Table 2-1 (Continued)
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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
44/AF SITES[5,6]	MB	***4/Dark Green***	2816 & 2817	Former Missile Training Range	Possible PCE plume (Missile Training Range) and BTEX contamination (former motor pool).	Site-screening studies completed 11/95. Field screening indicates localized BTEX and possible PCE/TCE contamination, but neither confirmed by monitoring wells. Six piezometers installed to evaluate groundwater flow anomaly. OPT recommended resampling of two SA 3 wells with PCE exceedances. Resampling did not detect PCE, but did reveal fuel-related compounds below screening criteria (benzene at 1 $\mu g/\ell$). ABB-ES submitted report recommending transfer of property with a color change from 7/Gray to 4/Dark Green. OPT is reviewing report.
		4/Dark Green	Former 2721	Silk-screening facility	Alleged disposal area for solvents and paints when silk-screening operation closed.	Site-screening studies completed 11/95. Geophysical anomalies were investigated with two monitoring wells. Groundwater has no exceedances, but ABB-ES recommended a limited test-pitting program to determine source of geophysical anomalies. Test pitting completed 9/96, uncovered the buried foundations of Buildings 2721 and 2722. Site approved for transfer.
45 AF SITES[5]	MB	***1/White***	125	Alleged disposal area near Building 125	Alleged landfill with unknown contents.	Field screening completed in March 1996. The analytical results indicate no environmental concerns. Site has been approved for transfer pending a review of Florida secondary drinking water standards (FSDWS) exceedances in groundwater. ***Site approved for transfer on June 19, 1997.***

See notes at end of table.

Table 2-1 (Continued)
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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
OU 1[3] (MAIN BASE)	MB	3/Light Green	21	RTC Fitness Trail	Potential impact from North Grinder Landfill (contents of landfill not well documented).	Draft remedial investigation report submitted to Navy on 4/4/96. ABB-ES concluded (1) PAH contamination in surface soil does not pose unacceptable risks (USEPA and FDEP concur); (2) elevated gross alpha/gross beta in several wells adjacent to landfill are due to naturally occurring radionuclides that have been mobilized by altered groundwater chemistry near and under the landfill; (3) a landfill cap will not be required (USEPA and FDEP concur); and (4) groundwater should be monitored in downgradient wells to determine if there are any changes in contaminant concentrations as a function of time (USEPA and FDEP concur).
		3/Light Green	4004	North Grinder (paved)		At the request of the OPT, ABB-ES installed two upgradient wells (one at intermediate depth [OLD-U1-28B] and one deep in the shallow aquifer [OLD-U1-29C]) to evaluate a potential upgradient RADs source. The lab results indicate RADs activity above background in both wells (gross alpha/beta in OLD-U1-28B 44.2/31.7 pCi/ℓ versus background screening value of 13/9.5 pCi/ℓ, in OLD-U1-29C 22.9/32.1 pCi/ℓ). However, filtered samples had RADs activity significantly lower than background in both wells.
		3/Light Green	4005	North Grinder (grass)		The OPT approved all comment responses and the final RI report was submitted on 12/19/96. The (draft) Proposed Plan, which contains a recommendation of groundwater monitoring, was submitted in April and the (draft) Record of Decision document ***was submitted in June. The final Proposed Plan was also submitted in June, and a public meeting for the Proposed Plan was held on May 22, 1997.***
		3/Light Green	4021	South Grinder (paved)		
		3/Light Green	4022	South Grinder (grass)		

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
OU 3	MB	6/Red	2134	Greenskeeper Storage	Confirmed arsenic in soils; an interim remedial action (IRA) will be required, which is anticipated to be soil removal.	Soil samples had elevated levels of arsenic (up to 577 mg/kg) versus a noncarcinogenic RBC of 23 mg/kg. Soil also had elevated levels of benzo(a)pyrene. Groundwater had elevated levels of arsenic (up to 425 $\mu g/l$ versus 50 $\mu g/l$ MCL). A PRE was conducted and indicated no ecological risk; however, health risk was higher than 1×10^{6}. The Greenskeeper Storage Area will require further study and, along with SA 9, has been designated OU 3. ***The draft RI/FS Workplan was completed in June 1997. Fieldwork is anticipated to begin in Fall 1997.***
OU 3	MB	6/Red	UNF-14	Former Pesticide and Herbicide Storage	Pesticide and herbicide releases may have occurred during operation of facility; an IRA will be required.	Soils had benzo(a)pyrene above SCGs. Also chlordane up to 2900 mg/kg versus screening value of 490 mg/kg. A PRE was conducted indicating no ecological risk, but human health risk was higher than 1×10^{-6}, and the site will require remediation and, along with the Greenskeeper Storage Area in SA 8, has been designated OU 3. ***Fieldwork is anticipated to begin in Fall 1997.***
16 GRP III	MA	***2/Blue***	7168	Maintenance Yard	Potential release from an oil-water separator.	Fieldwork for Group III sites began on 3/13/95 and concluded on 6/5/95. The (draft) Group III report was submitted to the Navy on December 15, 1995. There were significant detections of PAHs in four surface soil samples that slightly exceeded SCGs for some PAH compounds; there were small exceedances of magnesium, Mn, and zinc in four subsurface soil samples. Mineral spirits were present as free product in a well adjacent to an oil-water separator in the northern corner of the site. The site has been transferred to the UST program for evaluation. ***Site transferred to NTC TMP in October 1996 with color change to 2/Blue.***
		2/Blue	7171	Army Motor Transportation	Potential release from an oil-water separator.	
			7172	Army Battery Shop	Stained soil associated with used battery storage, possible release of sulfuric acid from inside.	

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
17 GRP III	MA	7/Gray	7178	Training Material Storage	Evidence of paint dumped down the drains of adjacent wash rack.	Analytical results for SA 17 are indicated below. One groundwater sample showed significant detections of chlorinated hydrocarbons exceeding MCLs (TCE at 42 $\mu g/\ell$, VC at 190 $\mu g/\ell$, and cis-1,2-DCE at 200 $\mu g/\ell$); there were also exceedances of FDEPG for vanadium, aluminum, Mn, and iron. Surface soils had exceedances of several PAHs in two samples; subsurface soils had exceedances of several PAHs in three samples. A test-pitting study to determine source of geophysical anomaly revealed items of no environmental significance. A workplan to address chlorinated hydrocarbons in groundwater has been approved. ***Fieldwork is scheduled for Fall 1997***. PAH delineation is on hold pending results of groundwater delineation. Color code should become 6/Red for Motor Pool Compound and drum storage area, but 7/Gray for the remaining area pending chlorinated solvent groundwater plume assessment and resolution of PAH contamination.
		7/Gray	7191	DPDO Warehouse	Ground staining and paint dumping evident.	
		7/Gray		Army Maintenance Office	Hazardous waste drum storage and alleged burial.	
		6/Red	7190	Army Motor Pool Compound and drum storage area adjacent to 7190	Site used as a motor pool and vehicle storage compound.	

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
18 GRP III	MA	7/Gray	7182	Housing Office	Hazardous materials including paint, solvents, compressed gases, and petroleum products stored there.	Analytical results for SA 18 are indicated below. Aluminum, iron, lead, Mn, thallium, and vanadium exceed background screening concentrations in one groundwater sample, which may have been affected by suspended particulates (TSS = 106 mg/ℓ); resampling on 6/18/96 had significantly lower concentrations for all prior exceedances, with aluminum and iron the only analytes still exceeding background screening concentrations (5,620 and 5,410 μg/ℓ, respectively). Surface soil detections of PAHs at two locations slightly exceeded their respective SCGs. ABB-ES has prepared a letter with recommendations for additional studies for SA 18 and other sites with PAHs in surface soil. ABB-ES also prepared a letter with recommendations for language to discuss FSDWS exceedances in groundwater; OPT is reviewing both letters. Color code should remain 7/Gray pending PAH issue.
19 GRP III	MA	1/White	7184	Auto Hobby Shop	Use of site as an auto hobby shop soil staining from waste oil evident.	Analytical results for SA 19 indicate no significant detections in any media sampled. The site was approved for transfer during the March OPT meeting. OPT will be reviewing the final report, which recommends No Further Action (NFA).
20 GRP III	MA	2/Blue	7187	Storage	Probability of pesticide storage.	Analytical results for SA 20 indicate no significant detections in any medium sampled. The site was approved for transfer during the March OPT meeting. Color code will remain 2/Blue due to petroleum contamination. ***Property approved for transfer in June 1997.***
21 GRP III	MA	7/Gray	7203	Maintenance Shop	Diesel fuel spill in 1993 from a leaking AST and former pesticide storage.	Analytical results for SA 21 indicate slight exceedances of SCGs for PAHs and arsenic in surface soil. Concerns regarding arsenic have prompted FDEP to have SA 21 reviewed by their risk assessment group. ***Field investigation to evaluate PAHs in surface soil completed in June 1997. Analytical results are forthcoming.*** Color code should remain 7/Gray pending resolution of PAH issue and exceedances of FSDWS.

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
22 GRP III	MA	1/White	UNF-1	Old Golf Course	Alleged disposal of engines, bomb shells, and spent ordnance in Lake Stanley.	Analytical results for SA 22 indicated no significant detections in surface water, sediment, or groundwater. Aluminum, iron, and lead exceeded surface water standards. Sampling to evaluate allegations of landfilling have been completed and a limited test-pitting program to evaluate geophysical anomalies was completed in September 1996 with no findings of environmental concern. A UXO survey performed by the Mayport EOD team did not reveal any items related to UXO disposal. ***Color code change from 7/Gray to 1/White and transfer approved in June 1997.***
23 GRP III	MA	7/Gray	UNF-2	Former officers swimming pool and bathhouse (Building 7119)	Area used as a disposal pit for demolition debris, possibility of an unidentified UST.	Analytical results for SA 23 indicate exceedances for PAHs in one surface soil sample at the end of the 12-inch drain to the former swimming pool, leading to a recommendation to further evaluate the source of PAHs and "hot spot" delineation. Resampling of surface water/sediment at the drain opening during a storm event resulted in nondetects for SW, but exceedances of regulatory criteria for 5 PAHs in SED (a benzo[a]pyrene concentration of 5,400 μg/kg versus an RBC of 88 μg/kg).
24 GRP III	MA	***1/White***	UNF-4	Northwest Swamp	Former disposal area for construction debris.	Analytical results for SA 24 indicate exceedances of some inorganics (aluminum, iron, Mn, potassium, vanadium) in groundwater, which may have been affected by the high suspended particulate (TSS = 500 and 360 mg/ℓ).
		1/White	UNF-5	Southeast Swamp	Former domestic wastewater treatment plant (DWTP) at the southeastern area, demolition debris.	ABB-ES presented results of a study to determine the relationship between high TSS/turbidity and elevated concentrations of inorganics above secondary groundwater standards. ***Property approved for transfer by OPT in June 1997 with color change from 7/Gray to 1/White.***

See notes at end of table.

Table 2-1 (Continued)
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Site-Screening SAs/Operable Units for Main Base (MB), McCoy Annex (MA), Area C (AC), and Herndon Annex (HA)						
SA	**Location**	**BRAC Color Code**	**Building Number**	**Name**	**Reason for Investigation**	**Current Status**
25 GRP III	MA	7/Gray		Former DWTP - McCoy Annex	Suspect due to the nature of the facility.	Analytical results for SA 25 indicate iron and Mn exceedances in groundwater and slight exceedances of PAHs and pesticides in surface and subsurface soils. Resampling of OLD-25-03 for Mn on 7/25/96 determined a concentration of 662 $\mu g/\ell$ versus a FSDWS of 50 $\mu g/\ell$. ABB-ES will recommend color code change from 7/Gray to 1/White.
26 GRP III	MA	1/White	7351	Camp Bath House (RV Park)	Past use as an airfield strip and drum storage area.	Analytical results for SA 26 indicate no significant contamination in any medium sampled, with the exception of PAH exceedances in adjacent surface soil samples reported in the Background Sampling Report . SA 26 was approved for NFA during the March OPT meeting. Evaluation of PAH contamination in the vicinity of the two background surface soil samples was completed, confirming prior detections of PAHs, although at somewhat lower total PAH concentrations. ***Field investigation to delineate limits of PAH impact completed in July 1997. Analytical results are forthcoming.*** ABB-ES finalized report recommending color code change from 7/Gray to 1/White. Signed by OPT ***in June 1997.***
		1/White	7352	Camp Laundry	Same as above.	
		1/White	7357	Family Camp Office	In close proximity to the old airstrip, drums once stored here.	
		1/White	7358	Family Camp	Past use as an airstrip and drum storage area.	
46 AF SITES[5]	MA	1/White		Sewage disposal pit as part of DWTP	Within SA 25 (GRP III); alleged disposal of nondomestic wastes.	SA 46 designated AEC-MC-01 in Technical Memorandum, U.S. Air Force Records Search. Screening investigation completed in June 1996, and results indicated no evidence of environmental impact. Site has been approved for transfer; color change from 7/Gray to 1/White.
47 AF SITES[5]	MA	1/White		Former skeet range	Potential lead contamination; near SAs 25 and 26.	SA 47 designated AEC-MC-06 in Technical Memorandum, U.S. Air Force Records Search. Screening investigation completed in June 1996, and results indicated no evidence of environmental impact. Site has been approved for transfer; color change from 7/Gray to 1/White.

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
48 AF SITES[5]	MA			Former auto, boat, and carpentry hobby shop	Potential contamination from past site use.	Site-screening investigations were completed in May 1996. The analytical results revealed a single pesticide (DDE) slightly above the screening level in one groundwater sample and a metal detector anomaly indicated a possible UST. Well OLD-48-03 was resampled for DDE 11/96: no pesticides were detected. GPR survey did not reveal a potential UST. ***Property approved for transfer in June 1997 with color change from 7/Gray to 1/White.***
49 AF SITES[5]	MA	7/Gray		Former disposal area	Potential contamination due to landfill with unknown contents; near SAs 24, 46, and 47.	SA 49 designated AEC-MC-17 in Technical Memorandum, U.S. Air Force Records Search. Screening investigation completed 6/96. Preliminary geophysical results show no evidence of disposal activities. There are FSDWS exceedances in groundwater (aluminum and iron). ABB-ES prepared a letter with recommendations for language to discuss FSDWS exceedances in groundwater; OPT is reviewing the letter.
50 AF SITES[5]	MA	1/White 7/Gray 2/Blue 7/Gray 1/White 7/Gray	7189 7178 7253 7174 RV Storage 7182	Former civil engineering yards (Buildings 7179 and 7182 investigated as SA 18; Building 7178 investigated as SA 17).	Potential contamination due to past site use activities.	Site-screening activities began in April 96, completed in May 1996. Analytical results indicate two surface soil samples with benzo(a)pyrene concentrations exceeding residential soil screening levels, but below industrial screening levels. ABB-ES will recommend NFA for all structures except Building 7174, which is still being evaluated because of the release of petroleum substances. ABB-ES has recommended color code change for Building 7189 and RV storage area from 7/Gray to 1/White; Building 7253 and RV storage compound were investigated under TMP, resulting in clean closures. Building 7174 requires remediation of petroleum groundwater plume. Site is transferable with a restriction to future industrial reuse.

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
51 AF SITES[5]	MA	1/White	7159	Former electrical substation	Potential PCB contamination due to spills and other incidents.	Site-screening activities were completed in August 1996. No PCBs were detected during field screening (immunoassay test kits) or in confirmatory samples submitted to laboratory. Site has been approved for transfer with color code change from 7/Gray to 1/White.
52	MA	6/Red	Former Building 7261	Former Entomology Lab	Potential pesticide contamination due to past use of building.	Site-screening investigations were completed in May 1996. Two surface soil samples had up to four pesticides above screening levels. Also, two groundwater samples had exceedances for pesticides. ABB-ES has recommended color code change to 6/Red due to pesticide contamination. Additional site investigations (pesticide immunoassay test kits, piezometers, monitoring wells) have confirmed pesticide exceedances in surface soil and groundwater. Results were submitted to OPT in February. A soil removal action is planned to remediate the site.
53	MA	3/Light Green	Building 7262	Kwik Shoppe	Potential contamination due to past use as a coin-operated dry-cleaning facility.	Workplan submitted to Navy on April 3, 1996. Site screening began in April. Screening investigation completed in June 1996. Field screening results indicated minimal impact to surface/subsurface soil from PCE/TCE. Analytical results below screening criteria. Site has been approved for transfer with color change to 3/Light Green.

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
OU 2	MA	6/Red	7355	McCoy Annex Golf Course	OU 2 is a 99-acre landfill operated by the Air Force from 1960 until 1972 when the Navy took over the property. The Navy closed the landfill in 1978. A 9-hole golf course was constructed over the site, which is drained by a series of canals and retention ponds that discharge to Boggy Creek and Boggy Creek Swamp to the south. It is estimated that over 1,000,000 cubic yards of waste were disposed of in the landfill, and that the waste included paints and other solvents, asbestos, transformers, hospital wastes, low-level radiological waste, scrap metal, demolition debris, and yard waste.	The OU 2 workplan is being finalized by Brown & Root (B&R). All future work at OU 2 will be accomplished by B&R. The OU 2 workplan was finalized. The fieldwork has been approved and field efforts began May 5, 1997.
		6/Red	7354	Greenskeeper Storage		
		6/Red	7353	Golf Course Club House		
		6/Red	7356	Lawn Equipment Storage		

See notes at end of table.

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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
2 GRP I	HA	1/White	6001	Septic Tank/Leachfield	Exact contents of septic tank and drain field unknown (see "Other Areas" notes below for Herndon Annex Landfill).	No significant detections in shallow soil or shallow groundwater. No further investigation is required for Facility 6001, which is considered transferable (1/White). Field screening of the deep wells installed east of Building 606 and south of Building 610 indicate benzene concentrations of 21 and 32 $\mu g/\ell$, possibly related to former landfills at Herndon Annex. Additional field investigations indicate a probable off-site benzene source. A U.S. Army Corps of Engineers survey conducted for GOAA along the southern boundary of Herndon Annex was inconclusive in determining the benzene source. The presence of known landfilled areas may restrict future uses of the site. This land parcel was leased to the City of Orlando in December 1996. Additional groundwater screening was recently completed by ABB-ES to determine extent and source of benzene plume. Results indicate an upgradient source for benzene and other VOCs. Recent sampling of surface water in Lake Barton has occurred, ***resulting in detections of PCE at concentrations below surface water standards. Future screening east of the parcel to determine the extent of benzene plume will begin during Summer 1997.***
		7/Gray		Herndon landfill(s)	Potential contamination from unknown landfilled materials.	
43 AF SITES[5,6]	HA	3/Light Green	601	Indoor rifle and pistol range	Herndon Annex, potential lead contamination; see the remainder of SA 43 at Main Base (North Grinder Landfill skeet range, Building 229).	Eighteen surface soil samples (and 2 duplicates) collected and submitted for lead analysis in December 1995. One sample exceeded regulatory screening level. TCLP analysis for lead at the location of the highest lead concentration was below the RCRA regulatory limit, and lead is, therefore, not of environmental concern. The site has been approved for transfer with color change to 3/Light Green.

See notes at end of table.

Table 2-1 (Continued)
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SA	**Location**	**BRAC Color Code**	**Building Number**	**Name**	**Reason for Investigation**	**Current Status**
11 GRP II	AC	1/White	148	Cold Storage Warehouse (Area C)	Abandoned half-buried drum - Soil staining around generator pad transferred to UST program.	The field investigation for Group II sites was completed on April 6, 1995. Analytical results for SA 11 indicate no contaminants exceed guidance levels. Property has been approved for transfer.
12 GRP II	AC	6/Red	1061, 1063	DRMO warehouses and salvage yard		Transferred to OU 4, below.
13 GRP II	AC	6/Red	1100, 1101	NTC laundry and old heating plant		Transferred to OU 4, below.
14 GRP II	AC	6/Red	1102	Disposal, salvage and scrap building		Transferred to OU 4, below.
15 GRP II	AC	1/White	1053	CBU-419 Maintenance Shop	Diesel fuel spill reported.	Transferred to UST Program.
OU 4	AC	6/Red	1063 and 1061	DRMO Warehouses and salvage yard	Former hazardous waste handling and storage area; spills are suspected, and a former production well is on site.	Analytical results from initial screening investigation at SA 12 indicate no significant detections for soil, but that groundwater has PCE at 8 mg/ℓ versus an MCL of 5 $\mu g/\ell$. Results from supplemental screening activities indicated that shallow groundwater between Building 1100 (SA 13) and Lake Druid, as well as the surface water and sediment along the eastern edge of the lake, was significantly impacted with PCE and its daughter products (TCE, DCE, and VC). The IRA is a well-stripping system scheduled for installation in the fall of 1997. The RI/FS ***workplan was completed in July 1997. Fieldwork scheduled for Fall 1997.***

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
OU 4 (cont.) (SA 12 GRP II)						SA 12 has been grouped with SAs 13 and 14 and designated as OU 4. An RI/FS will be conducted at OU 4, but in the interim, a focused field investigation was started in May 1996 in order to better define the limits of impact for implementation of an IRA. The IRA focused field investigation is complete, and a pumping well and several observation wells have been installed to evaluate aquifer properties useful in evaluating treatment options. "In-well stripping" technology has been approved for the site. The system is currently being designed. An out-of-service production water well in the north-central portion of the area was abandoned in September 1996 to prevent contamination of the Floridan aquifer.
OU 4 (cont.) (SA 13 GRP II)	AC	6/Red	1100 (1101)	Laundry Dry Cleaners (Area C)	Several PCE spills documented; history of poor handling practices.	Passive soil gas and laboratory results from the initial screening investigation at SA 13 confirmed PCE and TCE contamination. Soil and groundwater have elevated levels of PCE and TCE. The highest contaminant concentration in soil was PCE at 220 mg/kg versus an SCG of 30 mg/kg. The highest levels in groundwater were PCE at 680 $\mu g/\ell$ and TCE at 52 $\mu g/\ell$ versus MCLs for both compounds of 3 $\mu g/\ell$.
OU 4 (cont.) (SA 14 GRP II)	AC	6/Red	1102	Disposal Salvage Scrap Building	Three-gallon spill of PCE.	Analytical results from the site screening indicate no significant detections for soil, but that groundwater has PCE and TCE concentrations of 46 and 20 $\mu g/\ell$ versus MCLs for both compounds of 3 $\mu g/\ell$.

See notes at end of table.

Table 2-1 (Continued)
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SA	Location	BRAC Color Code	Building Number	Name	Reason for Investigation	Current Status
Other Areas.						
ACM		7/Gray	2713	Administration Building		
ACM		7/Gray	2651	Recycling Center		
ACM		7/Gray	2450	Demolished		
ACM/LBP		1/White		Capehart Housing	Currently designated as 1/White.	ACM and LBP surveys completed in September 1995.

[1] Subject to change based on evolving evidence or knowledge.
[2] This area is in the southern portion of the Main Base golf course, near the small arms ammunition bunkers.
[3] This area also includes Building 208, the USS Bluejacket. The primary responsibility for this facility, however, lies within the UST program.
[4] Upon installation of additional monitoring wells and analysis of groundwater, a decision will be made regarding additional investigator requirements at this landfill.
[5] Sites discovered and/or reported in *Technical Memorandum, U.S. Air Force Records Search, Naval Training Center, Orlando, Florida* (ABB-ES, 1995a), and which will be investigated in accordance with workplan entitled *Site Screening Plan, Air Force Sites, Addendum 2, Naval Training Center, Orlando, Florida* (ABB-ES, 1995b).
[6] Sites previously considered, but which will be investigated in accordance with workplan entitled *Site Screening Plan, Groups I through V SAs and Miscellaneous Additional Sites, Addendum 1, Naval Training Center, Orlando, Florida* (ABB-ES, 1995c).

* = Changes for this revision are bolded and italicized.

Regulatory Limits and Guidelines for Analytical Parameters

- Groundwater - Maximum Contamination Limits (MCL), Federal and State promulgated
- Surface Water - FDEP Surface Water Quality Criteria (SWQC) Classes I through IV
- Soils - Risk-Based Concentrations (RBC) from USEPA Region III, Target Action Levels from FDEP (Screening guidelines only)
- Sediments - FDEP Sediment Quality Guidelines (SQG)
- No Observable Effects Level (NOEL)
- Probable Effects Level (PEL)
- (Screening Guidelines Only)

Notes continued on next page.

Table 2-1 (Continued)
Installation Restoration Program Non-UST/AST Investigation Synopsis*

Health and Safety Plan
Project Operations Plan for Site Investigations
and Remedial Investigations
Naval Training Center, Orlando, Florida

Notes (Continued):

UST/AST = underground storage tank/aboveground storage tank.
SA = site assessment.
BRAC = Base Realignment and Closure (Act).
GRP = Group.
UNF = unnumbered facility.
BEQ = Bachelor Enlisted Quarters
μg/ℓ = micrograms per liter.
MCL = maximum contaminant level.
OPT = Orlando Partnering Team.
RTC = Recruit Training Center.
Lt = lieutenant.
USAF = U.S. Air Force.
ABB-ES = ABB Environmental Services, Inc.
PCB = polychlorinated biphenyl.
DDE = dichlorodiphenyldichloroethane.
PAH = polynuclear aromatic hydrocarbon.
WWTP = wastewater treatment plant.
OU = operable unit.
Mn = manganese.
FDEPG = Florida Department of Environmental Protection Guidance.
Na = sodium.
pCi/ℓ = picocuries per liter.
IAS = initial assessment study.
BEHP = bis(2-ethylhexyl)phthalate.
NTC = Naval Training Center.
DFAS = Defense Finance Accounting Service.
PW = public works.
AF = Air Force.
BTEX = benzene, toluene, ethylbenzene, and xylenes.
J = estimated value.
mg/kg = milligrams per kilogram.
RAD = radiation.
HHRA = human health risk assessment.
TCLP = toxicity characteristic leachate procedure.
RCRA = Resource Conservation and Recovery Act.
PCE/TCE = perchloroethylene and trichloroethene.
USEPA = U.S. Environmental Protection Agency.
FDEP = Florida Department of Environmental Protection.
RBC = risk-based concentration.
RI = remedial investigation.
PRE = Preliminary Risk Evaluation.
FS = feasibility study.
SCG = soil cleanup goal.
DPDO = Defense Property Disposal Office.
VC = vinyl chloride.
DCE = dichloroethene.
TSS = total suspended solids.
mg/ℓ = milligrams per liter.
UXO = unexploded ordnance.
EOD = explosive ordnance disposal.
SW = surface water.
SED = sediment.
μg/kg = micrograms per kilogram.
GPR = ground-penetrating radar.
GOAA = Greater Orlando Aviation Authority.
VOC = volatile organic compound.
DRMO = Defense Reutilization and Marketing Office.
CBU = construction batallion unit.
ACM = asbestos-containing material.
LBP = lead-based paint.

hydrocarbons present at the site include benzene, toluene, xylene, and ethylbenzene.

Halogenated Aliphatic Hydrocarbons

Exposure to halogenated hydrocarbons cause depression of the central nervous system, decreased alertness, headache, sleepiness, and loss of consciousness. In addition, halogenated hydrocarbons can affect the kidneys, resulting in decreased urine flow, swelling (especially around the eye area) and anemia; and the liver, causing fatigue, malaise, dark urine, liver enlargement, and jaundice. Vinyl chloride is one of the more toxic of the halogenated aliphatic hydrocarbons and is know to cause cancer in humans. Other hydrocarbons in this group are also potential carcinogens. Halogenated aliphatic hydrocarbons present at the site include 1,1-dichloroethane, 1,2-dichloroethane, 1,1-dichloroethylene, 1,2-dichloroethylene, trichloroethylene, perchloroethylene, 1,1,1-trichloroethane, vinyl chloride, and methylene chloride.

Heavy Metals

Heavy metals are all toxic to the kidneys; however, each heavy metal has its own characteristic symptom cluster. Lead causes decreased mental ability, weakness (especially in the hands), headaches, abdominal cramps, diarrhea, and anemia.

2.4.2 Safety Hazards Workers may encounter the following safety hazards while working at NTC, Orlando.

Heavy Equipment

When working around heavy equipment, there is a potential for physical injury resulting from contact with any equipment that may be operating in the project area. Workers must be made aware of the presence of these hazards and take steps to avoid them. Workers will remain clear of heavy equipment and their loads at all times and will also remain outside the radius of reach for articulated equipment such as backhoes, trackhoes, and cranes. Subcontractors retained to operate such equipment will be solely responsible for the safety of their personnel.

Workers will also take extra precautions when working around heavy equipment when wearing respiratory protection. This is due to the limited ability to communicate while respirators are being worn. Workers and equipment operators shall determine suitable hand signals for use in communicating with each other, and these hand signals will be communicated to all site personnel during the initial site safety briefing and during the daily tool box meetings. Workers who operate the heavy equipment must be well trained in the use of their particular equipment.

Excavation Hazards

Physical hazards can arise from excavation activities; therefore, exposures will be minimized by *prohibiting personnel from entering the excavation (limiting the number of personnel allowed in an excavation)*. Some of the hazards associated with excavations include the possibility of cave-ins as well as the accumulation of gases and vapors. Entry into an excavation will only be allowed if the excavation has been properly sloped or shored and proper entrance and egress is provided according to OSHA Regulation 29, CFR 1926 Subpart P. In addition, atmospheric contaminant levels must be monitored and proper personal protective equipment (PPE) worn (See site-specific HASP addenda).

Buried Utilities

Because work operations involve intrusive activities, a potential for disturbance of underground utilities exists. In order to minimize the potential for accidents or interruption of utility service, all underground utilities will be identified prior to the startup of intrusive activities.

At least 3 days prior to the startup of intrusive activities, appropriate personnel at NTC, Orlando will be contacted in order to obtain clearance. The areas where intrusive activities will occur will be identified. The locator service and base utility personnel will respond and mark the ground surface for the following utilities, as appropriate:

Water	Cable
Electric	Natural Gas
Telephone	Sewer

ABB-ES personnel will get written verification that all utilities have been identified prior to commencing intrusive activities, whenever possible. Additional underground clearance support may be available through geophysical survey results.

Noise

Work will be conducted in areas with a potential for elevated noise levels. Hearing protection will be worn if noise levels exceed 85 decibels on a time-weighted average. Potential noise sources at the site include active heavy equipment such as drill rigs or excavators. Refer to Appendix T for additional information on hearing conservation measures.

Slips, Trips, and Falls

Workers at the site may be exposed to slip, trip, and fall hazards due to uneven terrain, presence of debris, or slippery surfaces. Workers will ensure that the site is maintained in a neat orderly manner to minimize tripping hazards. Workers will take proper care when walking on uneven surfaces. Proper footwear with adequate traction will be worn by all personnel when walking on slippery surfaces.

Heat Stress

Heat stress is a potential hazard at the site due to warm or hot weather and the use of PPE. PPE places an added strain on the worker due to the impermeable nature of the protective clothing that reduces the body's ability to cool down as well as the added weight to be carried. See Appendix K of HASP Part II for further information on Heat Stress.

Materials Handling

At NTC, Orlando, workers will be exposed to materials handling-related injuries due to the handling of heavy items at the site. These items include coolers, drums or buckets, gas cylinders, and heavy equipment. Mechanical aids such as handtrucks or forklifts will be used wherever possible to handle the heavy items. If the use of mechanical aids is not possible, two persons of approximately the same height will be required to lift the object. Refer to Appendix S for additional information on drum handling procedures.

Biological Hazards

Poisonous Insects, Snakes, and Plants. Workers may encounter poisonous insects, snakes, and plants while working in the field. Stings from ants, bees, wasps, hornets, and yellow jackets usually cause localized pain; however, they may, on occasion cause death. Death is usually due to the worker experiencing an acute allergic reaction to the poisons in the sting.

Workers may encounter ticks while working at the site. Ticks can transmit germs of several diseases including Rocky Mountain Spotted Fever and Lyme disease. Ticks adhere tenaciously to the skin or scalp and evidence shows that the longer an infected tick remains attached, the greater the chance that it will transmit disease (it usually has to be attached 24 hours to transmit Lyme disease). Refer to Table 2-2 for further information on Lyme disease.

Spiders in the U.S. are generally harmless, with the following two notable exceptions: the black widow spider and the brown recluse or violin spider. There is a potential for workers to encounter black widow and/or brown recluse spiders at the site. Prior to handling, equipment clothing, brushes, etc., should be checked for spiders.

In the U.S., there are many types of poisonous snakes. Pit vipers (such as rattlesnakes, copperheads, and water moccasins) typically have elliptical pupils and a pit between the eye and nostril on each side of the head. The venom of the pit vipers affects the circulatory system. Coral snakes, which are members of the cobra family, are found along the coast and lowland of the southeast. The coral snake has tubular fangs and round pupils. It is characterized by red, yellow, and black rings around the body with the red and yellow rings adjoining; the coral snake always has a black nose. The venom of the coral snake is very toxic and affects the nervous system. Nonpoisonous snakes typically have round pupils and no fangs or pits. Workers have a potential to encounter the following snakes at the site: rattlesnakes, water moccasins, and coral snakes.

Poisonous plants in the eastern U.S. include poison ivy and poison sumac. Poison ivy is a small plant, vine, or shrub with leaves consisting of three glossy leaflets. Poison sumac grows as a woody shrub or small tree from 5 to 25 feet tall. If contact with poison ivy or poison sumac is suspected, remove contaminated clothing and wash all exposed areas thoroughly with soap and water. Workers may potentially encounter poison ivy while working at the site.

Precautions will be taken to avoid poisonous insects, snakes, and plants if at all possible. If working in an area known to contain poisonous plants, workers will be instructed in how to identify the local variety. If the plants cannot be avoided, modified Level D PPE (uncoated, white tyveks are acceptable if no chemical contamination is present) will be used. Workers will be instructed to wash exposed skin with soap and water as soon as possible after work is completed and/or during breaks.

Table 2-2
Lyme Disease

Health and Safety Plan
Project Operations Plan for Site Investigations
and Remedial Investigations
Naval Training Center, Orlando, Florida

WHAT IS LYME DISEASE?

Lyme disease is an illness caused by a corkscrew-shaped bacterium called a spirochete, that is transmitted to humans, dogs, horses, and other animals by the bite of an infected deer tick (*Ixodes dammini*). While rarely life-threatening, if not treated, Lyme disease may lead to arthritis, neurological or cardiac problems, and possible birth defects.

WHERE IS LYME DISEASE FOUND?

Transmission of Lyme disease has been documented in many parts of the world, including the United States. While sporadic cases have been reported in many states, the disease does tend to occur largely in specific geographic areas. There are three such areas in the USA: (1) Wooded coastal portions of New York, Pennsylvania, New Jersey, and New England; (2) Wisconsin and Minnesota; and (3) wooded and coastal areas of Northern California and Southwest Oregon. It was first recognized in the U.S. in 1975 as the result of an investigation of a group of children with arthritis in Lyme, Connecticut.

HOW IS LYME DISEASE TRANSMITTED?

The bacteria that cause Lyme disease are acquired by juvenile deer ticks (larvae) through feeding on an infected animal, usually a mouse. At a subsequent stage in development (nymph), the ticks cling to vegetation in brushy, wooded, or grassy areas and transfer by direct contact to the skin of passing animals and humans. The bite of the infected tick can then transmit the bacteria to the new host. ***This transmission of the infectious organism appears to require that the tick be attached for at least 24 hours.***

The immature deer tick is very small and, when attached to the skin, may not be immediately noticeable. During its complex 2-year life cycle, the tick can infect a variety of hosts including white-footed mice, deer, and other wild and domestic animals as well as humans. Lyme disease is most commonly acquired in the summer months (June and July are peak), less often in early spring or late fall, and only rarely during the winter.

It is important to note that not all ticks carry Lyme disease. The common dog tick, for example, does not transmit the infection. Even a deer tick bite does not necessarily mean that disease will follow, because not all members of the species are infected. ***Prompt removal of a tick will greatly decrease the risk of disease transmission.***

See notes at end of table.

Table 2-2 (Continued)
Lyme Disease

Health and Safety Plan
Project Operations Plan for Site Investigations
and Remedial Investigations
Naval Training Center, Orlando, Florida

WHAT ARE THE SYMPTOMS OF LYME DISEASE?

Early Symptoms: The first symptom of Lyme disease is usually, but not always, a skin rash called erythema Migranes (EM). While the tick may have gone undetected, the rash occurs at the site of the bite. It begins as a small red area, 3 to 32 days after the bite, then gradually enlarges, often with partial clearing at the center, so that it resembles a doughnut. The expanding ring may exceed 6 inches in diameter, and the individual may experience a burning rather than an itching sensation at the site of the rash. Subsequent rings may appear inside the original ring so that the rash resembles a bulls-eye.

The rash may be accompanied by flu-like symptoms such as fever (100°-103°F), headache, stiff neck, sore and aching muscles and joints, nausea and vomiting, fatigue, sore throat, and swollen glands. There may be multiple rashes in other areas of the body that develop after the rash that occurs at the site of the bite. These symptoms may disappear on their own over a period of weeks. However, the rash may reoccur in about 50 percent of untreated people and more serious problems may develop later. Treatment with appropriate antibiotics clears up the rash within days and may prevent complications.

Late Symptoms: Three major organ systems (the joints, nervous system, and heart), can be affected weeks to months after the initial tick bite, although symptoms usually appear within 4 to 6 weeks. A large number of people with Lyme disease may develop symptoms during later stages without having had the early skin rash.

Arthritis in the large joints (primarily the knee, elbow, and wrist) occurs in more than 50 percent of untreated persons. The arthritis may move from joint to joint and can become chronic. Nervous system complications occur in 10 percent to 20 percent of infected persons. These complications may include Bell's palsy (facial muscles droop); pain and weakness, usually in the shoulder and upper arms; and poor concentration, depression seizures, and temporary paralysis (resembling Cuillian-Barre disease). Heart symptoms occur in 6 percent to 10 percent of infected persons (slowing of heart rate, irregular heart beat, shortness of breath, chest pains). Electrical conduction in the heart may be affected, and the heart muscle may become inflamed. Treatment with intravenous antibiotics can be helpful.

HOW IS LYME DISEASE DIAGNOSED?

The only positive proof of disease is culturing the bacteria from the tissue in the vicinity of the bite. Most often, diagnosis is based primarily on recognition of the typical symptoms of Lyme disease, especially the characteristic early rash, and on the history of possible tick exposure, such as outdoor activity in a high-risk area. Atypical cases or cases with only later stage complications can be difficult to diagnose. Lyme disease titer testing has become commercially available; however, this test is high in sensitivity, but lacks specificity. As a result, the incidence of false positives is extremely high. There are many cross reactions of the test with other bacteria. Because of this, the Centers for Disease Control (CDC) does not recommend the procedure for general patient screening. The CDC's recommendation is that the Lyme titer be reserved for patients whose symptoms suggest Lyme disease. In that circumstance, an acute serum should be collected and 3 weeks later, a convalescent serum should be collected. Because of variability in the testing, both samples should be done together at the laboratory in the same batch of specimens.

WHAT IS THE TREATMENT FOR LYME DISEASE?

Oral antibiotic treatment is beneficial early in the illness. Two commonly used medications in the setting are tetracycline and amoxicillin, although other antibiotics may be substituted. Prompt treatment of early Lyme disease may prevent later and more serious complications. Treatment of joint and nervous system complications is often accomplished with antibiotics given intravenously or by injection.

WHAT SHOULD YOU DO IF YOU FIND A TICK ON YOU WHILE AT AN ABB-ES SITE?

If you find a tick on you, and it has been on you less than 24 hours, you probably did not get infected. Remember, it is only the deer tick (or the blacklegged tick in the western United States) that carries the disease. The dog tick (larger than the deer tick) has not been implicated.

If you were bitten by a deer tick and you either develop symptoms or are very concerned about being infected, go see a doctor and follow his/her recommendations. Fill out an accident report and turn it in to Cindy Sundquist (Portland) or your local Workers Compensation (WC) administrator. The claim and all bills should be submitted to your local WC insurance carrier. If, for some reason, the claim gets denied, contact Cindy Sundquist, Portland ext 3309.

Note: °F = degrees Fahrenheit.

If working in areas with poisonous insects or snakes, workers will wear at least ankle high or calf high rubber or leather boots; tyveks; or long-sleeved shirts buttoned at the wrist, and long pants tucked into socks or boots. In addition, insect repellent, such as Deet, should also be used to repel insects.

In addition to poisonous plants, insects, and snakes, workers may encounter warm blooded animals, such as dogs, cats, raccoons, etc., that can transmit rabies and/or hantavirus.

Rabies: Rabies is a disease that is transmitted to humans through the bite of rabid domestic or wild animals. Exposure can also occur through contact with the saliva of an infected animal should it encounter broken skin or mucous membranes of the eyes, nose, or mouth. In the U.S., the principal reservoir that presents a threat to man consists of the skunk, the fox, the bat, and the raccoon. Rabies is caused by a virus that requires an incubation period from a few weeks to several months. Prevention of the disease is through avoidance of animal bites and caves containing infected bats. Workers will avoid contact with wildlife if at all possible. If a person is attacked and bitten by a wild animal that is suspected to be rabid, the individual will seek medical attention immediately. If it can be done safely, the animal in question will be collected and sent to the health department to determine if it is actually infected.

Hantavirus: Hantavirus is a viral disease that is transmitted to humans from exposure to rodents. Hantavirus does not cause illness in its receiver host. Infected rodents shed the virus in their saliva, urine, and feces. Human infection may occur after only a few minutes of exposure when infected saliva or excreta are inhaled as aerosols produced directly from the animal. Transmission may also occur when dried material, contaminated by rodent excreta, is disturbed and directly introduced into broken skin, the eyes, or possibly ingested in contaminated food or water. Workers in potentially high-risk settings should avoid contact with rodents and rodent burrows or disturbing their dens. Workers should wear chemical protective gloves if there is a potential for contact with nesting material or excreta. Gloves should be washed and disinfected before their removal. Wash hands and face with soap and water. Do not use cabins or enclosed shelters that are rodent infected. After working in such an area, workers should monitor their health for 45 days after last possible exposure. If a temperature or respiratory illness occurs within that timeframe, they should seek medical attention immediately and inform the attending physician of potential exposure.

Radiological Hazards

While workers are not expected to encounter radiological hazards, except in groundwater in the vicinity of North Grinder landfill (Operable Unit 1), radiation monitoring will be conducted using both dosimeter badges and radiation survey meters. Prior to site entry, workers will monitor background radiation in an area known to be free of radioactive hazards. If levels in the site show levels of activity significantly greater than background (more than twice background), site operations will halt and the ABB-ES HSM will be immediately contacted. Refer to Appendix U for additional information on ABB-ES's radiation monitoring program.

Other Hazards

UXO may potentially be of concern at some of the POIs. If this is the situation, a qualified contractor will first clear the areas prior to commencing subsequent tasks at POIs where UXO is a concern. Appendix V details the basic methodologies, concepts, and considerations that will be incorporated during the activities at these sites.

Safety hazards exist when personnel are working on boats or floating platforms; all persons must have the ability to swim and will wear personal flotation devices when working on boats or floating platforms.

The primary safety hazards associated with any intrusive work (test-pitting and drilling) at landfills include potential exposure to sharp medical wastes (syringes and broken glass), asbestos, other sharp and jagged pieces of metal or glass, and radioactive waste.

2.4.3 Levels of Protection Information regarding the levels of protection that will generally be used during investigation activities at NTC Orlando are listed below:

- geophysical survey, Level D
- test pit excavation and sampling, Modified Level D, or Level B if the information available is insufficient to identify the hazards
- boring and subsurface soil sampling, Modified Level D
- monitoring well installation and sampling, Modified Level D
- surface water and sediment sampling, ecological sampling, water-level measurement, and aquifer testing, Level D

Descriptions of each protective ensemble (i.e., Level A, Level B, etc.) are provided in Appendix E. Refer to the appropriate site-specific HASP addendum for specific levels of protection applicable to the ongoing activities.

Modified Level D protection is anticipated to be sufficient for a majority of the exploratory and sampling work to be conducted at the installation. Rarely are breathing zone levels of contaminants expected to increase to the point where respiratory protection is required; however, a photoionization detector (PID) or flame ionization detector (FID) and, possibly, Draeger tubes will be in use at each exploratory location to monitor the breathing zone. Refer to Subsection 2.4.5 for additional information on air monitoring.

2.4.4 Monitoring The work environment will be monitored to ensure that Immediately Dangerous to Life and Health (IDLH) or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for combustible atmospheres, oxygen-deficient environments, and hazardous concentrations of airborne contaminants. The combustible gas meter, set to alarm at 10 percent of the lower explosive limit (LEL), will be continuously used.

2.4.5 Air Sampling To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site and may also be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment may be used at the site:

1. dual detector (oxygen [O_2]/LEL)

2. HNU™ IS101 and Photovac total ionizables present (TIP™) photoionization detectors

3. colorimetric detector tubes (e.g., Mine Safety Associates or Draeger)

4. Heath Porta-FID organic vapor analyzers

5. radiation detectors (i.e., pancake Geiger Mueller [GM] detector or gamma scintillation detector)

Refer to Appendix F for information on the calibration and maintenance of the equipment.

To date, the only sites where air monitoring indicates the potential for upgrade to Level C respiratory protection have chlorinated organic compounds as the contaminants of concern. For such sites (where the contaminants of concern are tetrachloroethene [PCE], trichloroethene [TCE], dichloroethene [DCE], or vinyl chloride), the following monitoring and action levels are appropriate.

Vinyl chloride has the lowest threshold limit value of the listed contaminants; therefore, action levels will be based on the presence of vinyl chloride. The vinyl chloride Draeger tubes (0.5a) have a limited range of operating temperatures and humidities. Above certain temperature and humidity combinations, the tubes may not be accurate. Some typical limits are the following:

Temperature (°F)	Relative Humidity (%)
86	66
80	79
75	93
73	100

°F = degrees Fahrenheit.
% = percent.

Above 86 °F, the tubes should not be used, regardless of humidity. Below 73 °F, temperature and humidity limits are not likely to be exceeded in Orlando.

If ambient conditions exceed the above limits, any organic vapor analyzer (OVA) detections above background must be assumed to be vinyl chloride, as the Draeger tubes cannot be relied upon to show otherwise. Under these conditions, a Level B PPE upgrade would be required.

If the OVA reads steadily above background in the breathing zone, begin monitoring with vinyl chloride Draeger tubes. If vinyl chloride levels reach or exceed 0.5 parts per million (ppm) in the breathing zone, upgrade to Level B.

If vinyl chloride levels are below 0.5 ppm, continue working in modified Level D until the OVA reads 8 ppm above background in the breathing zone, at which time upgrade to Level C. If the OVA reads 116 ppm (or greater) above background, upgrade to Level B.

If the LEL meter reads 10 percent of the LEL or greater, up to 20 percent, use nonsparking tools. IF the LEL meter reads 20 percent of the LEL or greater, stop work and evacuate the site.

The above action limits are summarized below.

Level B PPE required:

Vinyl chloride Drager tube is greater than or equal to 0.5 ppm; or OVA is greater than or equal to 116 ppm; or OVA above background and weather conditions are outside the limits of the Draeger tubes.

Level C PPE required:

Vinyl chloride Draeger tube is less than 0.5 ppm, and OVA is greater than or equal to 8 ppm but is less than 116 ppm.

Level D PPE required:

Vinyl chloride Draeger tube is less than 0.5 ppm; and OVA is less than 8 ppm.

Wherever feasible, engineering controls will be used to avoid the need to upgrade from Level D. An example is the use of industrial-sized fans to blow hazardous vapors from the breathing zone.

2.4.6 Personal Monitoring

Thermoluminescent Dosimetry Body Badges. These devices are nonmechanical collection devices used to monitor for x-ray, beta, and gamma radiation exposure. They are worn by ABB-ES associates and sent to Landauer, Inc., for analysis on a quarterly basis.

Note: It is ABB-ESs policy that every associate wear dosimeters while on military installations.

Personal monitoring may be warranted (1) if there is a potential of exposure to a substance that has a specific substance OSHA standard (i.e., asbestos 29 CFR 1910.1001), or (2) to characterize the personal exposure of high-risk employees to the hazardous substances that they may encounter onsite. Refer to Appendix U for additional information on ABB-ES's radiation protection policy.

2.4.7 Hearing Protection All personnel exposed to noise levels in excess of 85 decibels will be required to wear hearing protection.

3.0 CHEMICAL HAZARDS RESPONSE INFORMATION SYSTEM (CHRIS) DATA SHEETS

These sheets were originally authored and assembled by the U.S. Department of Transportation (USDOT) and U.S. Coast Guard (USCG) for overland and oversea transportation information and guidelines, and are provided in this HASP to disseminate information needed for decision-making personnel during the transport and handling of chemicals. In addition, these sheets should be used to achieve better safety procedures and to prevent accidents.

CHRIS data sheets have been included for the following compounds that have been detected at concentrations exceeding cleanup guidelines at one or more areas: arsenic, benzene, beryllium, dichlorodiphenyltrichloroethane (DDT), ethylbenzene, gasoline, toluene, xylenes, TCE, cis-1,2-DCE, PCE, lubricating oil, diesel oil, fuel oils, and polychlorinated biphenyls (PCBs). CHRIS sheets for other contaminants of concern at specific study areas will be included in the site-specific health and safety plan addenda (Attachment A).

ARSENIC

ARX

Common Synonyms

Arsenic, solid
Arsenic, metallic
Gray arsenic

Solid crystals — Gray

Sinks in water.

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY.
Wear self-contained positive pressure breathing apparatus and full protective clothing.
Stay upwind and use water spray to "knock down" dust.
Stop discharge if possible.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Can be heated to burn in air.
POISONOUS GASES ARE PRODUCED IN FIRE.
Wear self-contained positive pressure breathing apparatus and full protective clothing.
Extinguish small fires: dry chemical, carbon dioxide, water spray or foam; large fires: water spray, fog or foam.

Exposure

CALL FOR MEDICAL AID.

DUST
POISONOUS IF INHALED.
Move victim to fresh air.
IF IN EYES OR ON SKIN, immediately flush with running water for at least 15 minutes; hold eyelids open if necessary.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED.
IF IN EYES OR ON SKIN, flush with running water for at least 15 minutes; hold eyelids open if necessary.
IF SWALLOWED and victim is CONSCIOUS and has not vomited, induce vomiting with syrup of ipecac.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.

Water Pollution

Effects of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

BENZENE

BNZ

Common Synonyms	Watery liquid — Colorless — Gasoline-like odor
Benzol Benzole	Floats on water. Flammable, irritating vapor is produced. Freezing point is 42°F.

Avoid contact with liquid and vapor. Keep people away.
Wear goggles and self-contained breathing apparatus.
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause headache, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

BERYLLIUM

BEM

Common Synonyms	Solid Silver color Odorless Sinks in water.

AVOID CONTACT WITH SOLID AND DUST. KEEP PEOPLE AWAY.
Wear dust respirator and rubber overclothing (including gloves).
Stop discharge if possible.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
POISONOUS GASES MAY BE PRODUCED IN FIRE.
Dust cloud may explode if ignited in an enclosed area.
Wear goggles and self-contained breathing apparatus.
Extinguish with dry graphite, soda ash, or other inert powder.
DO NOT USE WATER ON FIRE.

Exposure

CALL FOR MEDICAL AID.

DUST
POISONOUS IF INHALED OR IF SKIN IS EXPOSED.
If inhaled will cause coughing or difficult breathing.
If in eyes, hold eyelids open and flush with plenty of water.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

SOLID
POISONOUS IF SWALLOWED OR IF SKIN IS EXPOSED.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting.
IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS do nothing except keep victim warm.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

DDT

DDT

Common Synonyms Dichlorodiphenyltrichloroethane p, p' - DDT 1, 1, 1-Trichloro-2, 2-bis(p-chlorophenyl) ethane	Solid Colorless Odorless Sinks in water.

Avoid contact with solid.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with water, dry chemical, foam, or carbon dioxide.
Exposure	CALL FOR MEDICAL AID. **SOLIDS** Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, headache, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

ETHYLBENZENE

ETB

Common Synonyms	Liquid	Colorless	Sweet, gasoline-like odor
Phenylethane EB	Floats on water. Flammable, irritating vapor is produced.		

Avoid contact with liquid and vapor. Keep people away.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Shut off ignition sources and call fire department.
Stop discharge if possible.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE.
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear goggles, self-contained breathing apparatus, and rubber overclothing (including gloves).
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness or difficult breathing.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Will burn skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

OILS, FUEL: 2-D

OTD

Common Synonyms Diesel oil, medium	Oily liquid Yellow-brown Lube or fuel oil odor Floats on water.

Stop discharge if possible
Call fire department
Avoid contact with liquid
Isolate and remove discharged material
Notify local health and pollution control agencies

Fire	Combustible. Extinguish with dry chemical, foam, carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID **LIQUID** Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes Flush affected areas with plenty of water IF IN EYES, hold eyelids open and flush with plenty of water IF SWALLOWED, and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials Notify operators of nearby water intakes

OILS, FUEL: 2

OTW

Common Synonyms	Oily liquid / Yellow-brown / Lube or fuel oil odor
Home-heating oil	Floats on water.

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. Extinguish with dry chemical, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **LIQUID** Irritating to skin and eyes. If swallowed, will cause nausea, vomiting. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

GASOLINES: AUTOMOTIVE (<4.23g lead/gal)

GAT

Common Synonyms Motor spirit Petrol	Watery liquid — Colorless to pale brown or pink — Gasoline odor Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Extinguish with dry chemical, foam, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, headache, difficult breathing or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea or vomiting.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

OILS, MISCELLANEOUS: LUBRICATING

OLB

Common Synonyms	
Crankcase oil Transmission oil Motor oil	Oily liquid — Yellow-brown — Lube oil odor Floats on water.

Stop discharge if possible.
Call fire department.
Avoid contact with liquid.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. Extinguish with dry chemical, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **LIQUID** Irritating to skin and eyes. Harmful if swallowed. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Effect of low concentrations on aquatic life is unknown. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

TOLUENE

TOL

Common Synonyms	Watery liquid · Colorless · Pleasant odor
Toluol Methylbenzene Methylbenzol	Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Shut off ignition sources and call fire department.
Stay upwind and use water spray to "knock down" vapor.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	FLAMMABLE. **Flashback along vapor trail may occur.** **Vapor may explode if ignited in an enclosed area.** Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, foam, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **VAPOR** **Irritating to eyes, nose and throat.** **If inhaled, will cause nausea, vomiting, headache, dizziness, difficult breathing, or loss of consciousness.** Move to fresh air. If breathing has stopped, give artificial respiration. If breathing difficult, give oxygen. **LIQUID** Irritating to skin and eyes. If swallowed, will cause nausea, vomiting or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. **May be dangerous if it enters water intakes.** Notify local health and wildlife officials. Notify operators of nearby water intakes.

M-XYLENE

Common Synonyms			
1, 3-Dimethylbenzene Xylol	Watery liquid	Colorless	Sweet odor
	Floats on water. Flammable, irritating vapor is produced.		

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	FLAMMABLE **Flashback along vapor trail may occur.** **Vapor may explode if ignited in an enclosed area.** Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **VAPOR** **Irritating to eyes, nose, and throat.** **If inhaled, will cause headache, difficult breathing, or loss of consciousness.** Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. **LIQUID** **Irritating to skin and eyes.** **If swallowed, will cause nausea, vomiting, or loss of consciousness.** Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS. **Fouling to shoreline.** **May be dangerous if it enters water intakes.** Notify local health and wildlife officials. Notify operators of nearby water intakes.

o-XYLENE

XLO

Common Synonyms	
1, 2-Dimethylbenzene Xylol	Watery liquid Colorless Sweet odor Floats on water. Flammable, irritating vapor is produced.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	FLAMMABLE **Flashback along vapor trail may occur.** **Vapor may explode if ignited in an enclosed area.** Wear self-contained breathing apparatus. Extinguish with foam, dry chemical, or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **VAPOR** Irritating to eyes, nose and throat. If inhaled, will cause headache, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. **LIQUID** Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk. DO NOT INDUCE VOMITING.
Water Pollution	Dangerous to aquatic life in high concentrations. Fouling to shoreline. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

p-XYLENE

XLP

Common Synonyms	
1, 4-Dimethylbenzene Xylol	Watery liquid Colorless Sweet odor Floats on water. Flammable, irritating vapor is produced. Freezing point is 56°F.

Stop discharge if possible. Keep people away.
Call fire department.
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

FLAMMABLE
Flashback along vapor trail may occur.
Vapor may explode if ignited in an enclosed area.
Wear self-contained breathing apparatus.
Extinguish with foam, dry chemical, or carbon dioxide.
Water may be ineffective on fire.
Cool exposed containers with water.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause dizziness, difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
If swallowed, will cause nausea, vomiting, loss of consciousness.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
DO NOT INDUCE VOMITING.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
Fouling to shoreline.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

TRICHLOROETHYLENE

TCL

Common Synonyms	Watery liquid · Colorless · Sweet odor
Trichloroethylene Triclene; Algylen Chlorylen Gemalgene Trethylene Trichloran; Trilene	Sinks in water. Irritating vapor is produced.

Stop discharge if possible. Keep people away.
Avoid contact with liquid and vapor.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	Combustible. POISONOUS GASES ARE PRODUCED IN FIRE. Wear goggles and self-contained breathing apparatus. Extinguish with dry chemical, carbon dioxide, or foam.
Exposure	CALL FOR MEDICAL AID. **VAPOR** Irritating to eyes, nose and throat. If inhaled, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Move to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. **LIQUID** Irritating to skin and eyes. If swallowed, will cause nausea, vomiting, difficult breathing, or loss of consciousness. Remove contaminated clothing and shoes. Flush affected areas with plenty of water. IF IN EYES, hold eyelids open and flush with plenty of water. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk and have victim induce vomiting. IF SWALLOWED and victim is UNCONSCIOUS OR HAVING CONVULSIONS, do nothing except keep victim warm.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

1,2-DICHLOROETHYLENE | DEL

Common Synonyms			
Acetylene dichloride sym-dichloroethylene Dioform cis-1, 2-dichloroethylene trans-1, 2-dichloroethylene	Liquid	Colorless	Sweet pleasant odor
	Sinks in water. Flammable, irritating vapor is produced.		

Wear goggles and self-contained breathing apparatus.
Shut off ignition sources. Call fire department.
Stop discharge if possible. Keep people away.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire	FLAMMABLE. POISONOUS GASES MAY BE PRODUCED IN FIRE. Containers may explode in fire. Flashback along vapor trail may occur. Vapor may explode if ignited in an enclosed area. Extinguish with dry chemicals, foam or carbon dioxide. Water may be ineffective on fire. Cool exposed containers with water.
Exposure	CALL FOR MEDICAL AID. **VAPOR** If inhaled will cause dizziness, nausea, vomiting, or difficult breathing. Move victim to fresh air. If breathing has stopped, give artificial respiration. If breathing is difficult, give oxygen. **LIQUID** Harmful if swallowed. IF SWALLOWED and victim is CONSCIOUS, have victim drink water or milk.
Water Pollution	Effect of low concentrations on aquatic life is unknown. May be dangerous if it enters water intakes. Notify local health and wildlife officials. Notify operators of nearby water intakes.

TETRACHLOROETHYLENE

TTE

Common Synonyms	Watery liquid · Colorless · Sweet odor
Tetracap Perclene Perchloroethylene Perk	Sinks in water. Irritating vapor is produced.

Stop discharge if possible
Avoid contact with liquid and vapor.
Isolate and remove discharged material.
Notify local health and pollution control agencies

Fire

Not flammable.
Poisonous gases are produced when heated.

Exposure

CALL FOR MEDICAL AID.

VAPOR
Irritating to eyes, nose and throat.
If inhaled, will cause difficult breathing, or loss of consciousness.
Move to fresh air.
If breathing has stopped, give artificial respiration.
If breathing is difficult, give oxygen.

LIQUID
Irritating to skin and eyes.
Harmful if swallowed.
Remove contaminated clothing and shoes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.
IF SWALLOWED and victim is CONSCIOUS, have victim drink water
or milk.

Water Pollution

Effect of low concentrations on aquatic life is unknown.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

POLYCHLORINATED BIPHENYL — PCB

Common Synonyms			
PCB Chlorinated biphenyl Arochlor Halogenated waxes Polychloropolyphenyls	Oily liquid to solid powder Sinks in water.	Light yellow liquid, or white powder	Weak odor

Stop discharge if possible. Keep people away.
Avoid contact with liquid and solid.
Call fire department.
Isolate and remove discharged material.
Notify local health and pollution control agencies.

Fire

Combustible.
Extinguish with water, foam, dry chemical, or carbon dioxide.

Exposure

CALL FOR MEDICAL AID.

LIQUID OR SOLID
Irritating to skin and eyes.
Flush affected areas with plenty of water.
IF IN EYES, hold eyelids open and flush with plenty of water.

Water Pollution

HARMFUL TO AQUATIC LIFE IN VERY LOW CONCENTRATIONS.
May be dangerous if it enters water intakes.
Notify local health and wildlife officials.
Notify operators of nearby water intakes.

4.0 SITE CONTROL

4.1 ZONATION. The general zonation protocols that should be employed at hazardous waste sites are described in Appendix G. The site-specific zonations that will be used for activities during this project are described as follows:

- geophysical survey - as noninvasive activity, this will not require zonation control;
- drilling and well installation - an exclusion zone will be clearly defined as a taped-off area, and a contamination reduction zone (CRZ) and support zone will be established;
- test pit excavation - an exclusion zone will be defined as the area within 10 feet of the backhoe, test pit, and spoils pile; and
- TerraProbe™, CPT, groundwater, and surface water and sediment sampling will not require zonation, unless activities are being conducted in high-traffic areas.

4.2 COMMUNICATIONS. The field office will be equipped with a radio communications base station and a telephone. All field teams will be provided with a mobile hand-held radio to facilitate onsite communications. In addition, a portable mobile cellular telephone will be available in at least one onsite field vehicle. When radio communication is not used, the following air horn signals will be employed:

HELP	three short blasts	(. . .)
EVACUATION	three long blasts	(_ _ _)
ALL CLEAR	alternating long and short blasts	(_ . _ .)

4.3 WORK PRACTICES. General work practices to be used during ABB-ES projects are described in Appendix H. Specific work practices necessary for this project or those that are of significant concern are described as follows:

- Both onsite and offsite activities will take place in an active industrial area. Care will be taken to clear utilities, avoid overhead lines, and set up safety cones or barriers when working in heavily traveled lanes.
- The drilling contractor will have documented safety and emergency action procedures for the equipment to be operated. The drilling contractors employees will acknowledge in writing that they have read and understand these procedures.
- The drilling contractor will ensure that the equipment is well maintained, meets safety requirements, is inspected daily during use, and has all required safety equipment, i.e., 20-pound A:B:C fire

extinguisher, emergency stops, etc. Boring tools will be in good condition and will be adequate for the work to be performed.

- The drilling/TerraProbe℠/CPT rig will be operated by a qualified operator who can identify pending failures and supervise the drillers helper(s). Transportation of the drill rig to the work site will be performed by a person with the proper commercial license.

- To the extent possible, the terrain should be level and the condition of the ground such that unexpected movement of the drill rig is unlikely. If the slope of the terrain is hazardous, the project manager or technical lead and the Navy will be contacted for the selection of a safe drilling site.

- ABB-ES personnel and subcontractors will comply with the State, local, and installation motor vehicle laws and regulations. Special circumstances such as current and anticipated hazardous road conditions will be addressed at safety briefings.

5.0 DECONTAMINATION AND DISPOSAL

All personnel and/or equipment leaving contaminated areas of the POI will be subject to decontamination, which will take place in the CRZ. General personnel and equipment decontamination practices used during ABB-ES projects are described in Appendix L, and detailed equipment decontamination procedures are addressed in Volume I, Section 4.3 of this document.

5.1 PERSONNEL DECONTAMINATION. All personnel will follow standard decontamination practices when leaving hazardous waste POI, including proper decontamination, and removal and disposal of PPE and tools. Personal protection levels for decontamination will correspond with the level of protection used during the field activity.

5.2 SMALL EQUIPMENT DECONTAMINATION. Small equipment will be protected from contamination as much as possible by keeping the equipment covered when at the site and placing the equipment on plastic sheeting, not the ground. Sampling equipment used at the site will be used only once or will be field cleaned between sampling.

5.3 HEAVY EQUIPMENT DECONTAMINATION. Drilling rigs and other heavy equipment will be cleaned with high-pressure water or steam, followed by an alconox/liquinox and water wash and rinse. Loose material will be removed with a brush. Downhole tools and heavy equipment will be decontaminated in accordance with procedures outlined in Volume I, Section 4.3 of this document.

A decontamination pit will be constructed downwind of the POI to allow collection of decontamination fluids at large-scale or long-term investigation locations. For other locations where heavy equipment will be used, a temporary decontamination pad will be constructed.

5.4 DISPOSAL OF CONTAMINATED MATERIALS. Investigation-derived wastes will be collected, screened, and stored or disposed of properly. In general, discarded materials, waste materials, or other objects will be handled in such a way as to preclude the potential for spreading contamination, creating a sanitary hazard, or causing litter to be left onsite. Potentially contaminated materials, e.g., clothing, gloves, etc., will be bagged or drummed as necessary and segregated for disposal. If radioactive waste or contamination is encountered in the contaminated materials, the wastes generated from work activities will be handled as low-level radioactive waste unless proven otherwise. Contaminated waste materials will be disposed of as required by provisions included in the contract and consistent with NTC, Orlando and regulatory provisions. All noncontaminated materials will be collected and bagged for appropriate disposal as normal domestic waste.

Further details can be found in Volume I, Section 4.10 of this document.

6.0 EMERGENCY AND CONTINGENCY PLAN

This chapter identifies emergency and contingency planning that has been undertaken for operations at this site. Most sections of the HASP provide information that would be used under emergency conditions. General emergency planning information is addressed in Appendix M. The following sections present site-specific emergency and contingency planning information.

6.1 PERSONNEL ROLES, LINES OF AUTHORITY, AND COMMUNICATION. The site HSO or the Health and Safety designee is the primary authority for directing operations at the site under emergency conditions. All communications both onsite and offsite will be directed through the HSO or designee.

6.2 EVACUATION. At NTC, Orlando, severe hazard conditions are not anticipated. However, in the event that abnormal levels of toxic gases are encountered, the following evacuation measures have been established.

In the event of an emergency situation such as fire, explosion, significant release of toxic gases, etc., an air horn or other appropriate device will be sounded for three long blasts indicating the initiation of evacuation procedures. All personnel will evacuate the work area. The location of safe areas will be upwind of the POI. For efficient and safe site evacuation and assessment of the emergency situation, the HSO will have authority to initiate proper action if outside services are required. Under no circumstances will incoming personnel or visitors be allowed to proceed into the area once the emergency signal has been given. The HSO must see that access for emergency equipment is provided and that all combustible apparatus have been shut down once the alarm has been sounded. Once the safety of all personnel is established, the proper NTC, Orlando officials will be notified by telephone of the emergency.

The HSO will notify local fire and police departments, and other appropriate emergency responders, if LEL values are above established action levels in the work zone, or if an actual fire or explosion has taken place.

6.3 EMERGENCY MEDICAL TREATMENT AND FIRST AID. Any personnel injured onsite will be rendered first aid as appropriate and transported to competent medical facilities for further examination and/or treatment. The preferred method of transport is through professional emergency transportation means; however, when this is not readily available or would result in excessive delay, other transport will be authorized. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

When an injury occurs in the exclusion zone, provisions for decontamination of the victim will be made. However, life-threatening conditions may preclude normal decontamination procedures. In such cases, arrangements will be made with the medical facility and transporter to provide for the situation.

7.0 OTHER

7.1 ILLUMINATION. Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light meeting the 5-foot candle requirement of 29 CFR 1910.120, operations must halt in time to permit personnel and equipment to exit the exclusion zone and proceed through decontamination during adequate daylight. Conversely, operations will not be permitted to begin until adequate lighting is present. Refer to Appendix P for additional information.

7.2 EXCAVATION. Site excavations created during site operations will be shored or sloped to prevent accidental collapse and otherwise conducted in accordance with Subpart P of 29 CFR 1926, as summarized in Appendix J. Under no circumstances will site personnel enter excavations that are not adequately shored or sloped. Where entry into an excavation does occur and it would even remotely be considered a confined space, such an entry will be made in accordance with the confined space entry program addressed in Section 7.3 and under provision of Appendix I.

7.3 CONFINED SPACE ENTRY. Confined space entry presents special problems and substantial risks to personnel who would be involved directly in the entry and those that might be called on to attempt a rescue of the initial entrants. Therefore, entry into a confined space is a MEANS OF LAST RESORT and will only be permitted where no other mechanism is feasible to achieve the desired goal. If confined space entry is required, entry will be conducted under provisions of Appendix I.

8.0 ADMINISTRATION

8.1 PERSONNEL AUTHORIZED DOWNRANGE. Personnel authorized to participate in exclusion zone activities at NTC, Orlando have been reviewed and certified for site operations by the TOM and the HSM. Certification involves the completion of appropriate training, a medical examination, and a review of this HASP and appropriate site-specific HASP addenda. All persons entering the site must use the buddy system and check in with the site manager and/or HSO before going downrange. Specific personnel assigned to each investigation will be identified in each site-specific HASP addendum.

8.2 HASP APPROVALS. By their signatures, the undersigned certify that this HASP will be used for the protection of the health and safety of all persons entering this site.

Robert Burns NTC, Orlando Health and Safety Officer	7-·-97 Date
John Kaiser Task Order Manager	8-11-97 Date
Cynthia Sundquist ABB-ES Health and Safety Manager	8/4/97 Date

8.3 FIELD TEAM REVIEW. I have read and reviewed the health and safety information in the HASP. I understand the information and will comply with the requirements of the HASP.

Name	Date

Name	Date

8.4 MEDICAL DATA SHEET. This Medical Data Sheet will be completed by all onsite personnel and will be kept in the support zone during site operations. It is not a substitute for the Medical Surveillance Program requirements consistent with the ABB-ES Corporate Health and Safety Program for Hazardous Waste Sites. This data sheet will accompany any personnel when medical assistance or transport to hospital facilities is required. If more space is required, use the back of this sheet.

Project: NTC, Orlando

Name: ______________________________

Address: ______________________________

Home telephone: Area Code ( ) ____________

Age: ____ Height: ____ Weight: ___

In case of emergency, contact: ______________________________

Address: ______________________________

Telephone: Area Code ( ) ____________

Do you wear contact lenses? Yes ( ) No ( )

Allergies: ______________________________

List medication(s) taken regularly: ______________________________

Particular sensitivities: ______________________________

Previous/current medical conditions or exposures to hazardous chemicals: _____

____

Name of personal physician: ______________________________

Telephone: Area Code ( ) ____________

8.5 EMERGENCY TELEPHONE NUMBERS.

Orlando Police Department	911
Main Base Police Emergency	(407) 646-4444
Rescue Service	911
Primary Hospital	
Main Base (Winter Park Memorial Hospital)	(407) 646-7320
Area C (Florida Hospital)	(407) 897-1940
Herndon Annex (Orlando General Hospital)	(407) 275-5150
McCoy Annex (Orlando Regional Medical Center)	(407) 841-5111
Alternate Hospital	
Main Base and Herndon Annex (Florida Hospital)	(407) 897-1940
Area C (Winter Park Memorial Hospital)	(407) 646-7320
McCoy Annex	None
Fire Department	
Main Base	(407) 646-4333
General	911
Offsite Emergency Services	911
Health Resources, Inc. - Dr. Winters (normal business hours)	(800) 350-4511
(after hours - pager - leave area code and number)	(800) 455-0964
Poison Control Center	(800) 962-1253
National Response Center	(800) 424-8802
Regional USEPA Emergency Response	(904) 488-1554
NTC, Orlando Officer of the Day	(407) 646-4501
Site HSO and FOL: Refer to site-specific addenda	
TOM: John Kaiser	(407) 895-8850
ABB-ES HSM: C.E. Sundquist	(207) 775-5401x3309(w)
	(207) 892-4402 (h)

8.6 ROUTES TO EMERGENCY MEDICAL FACILITIES. In the event of a life-threatening situation, the Naval Hospital on the Main Base will provide care. For less critical situations, or if medical assistance is required at other than the Main Base, the following sources of medical assistance apply. The NTC, Orlando Officer of the Day must be informed of any incident or accident that requires medical attention as soon as possible.

The primary source of medical assistance for Main Base is the following:

Facility Name: Winter Park Memorial Hospital

Address: 200 Lakemont Avenue, Winter Park, FL

Telephone Number: (407) 646-7000; Emergency (407) 646-7320

Directions to primary source of medical assistance from Main Base (Figure 8-1):

From project site, leave Main Base going north through the North Gate. Continue north on Lakemont Avenue for about 1.7 miles. The hospital is on the right between the intersections of Mizell Avenue and Aloma Avenue.

The primary source of medical assistance for Area C is the following:

Facility Name: Florida Hospital

Address: 601 E. Rollins Street, Orlando, FL

Telephone Number: (407) 896-6611; Emergency (407) 897-1940

Directions to primary source of medical assistance from Area C (Figure 8-1):

From project site, leave Area C and turn right onto Maguire. Continue to Colonial Drive (SR 50). Turn right (west) and continue to Mills Avenue (Highway 17/92). Turn right (north) on Mills Avenue, heading to Rollins Street. The Florida Hospital is on the left (west) side of Mills Avenue, at the intersection with Rollins Street.

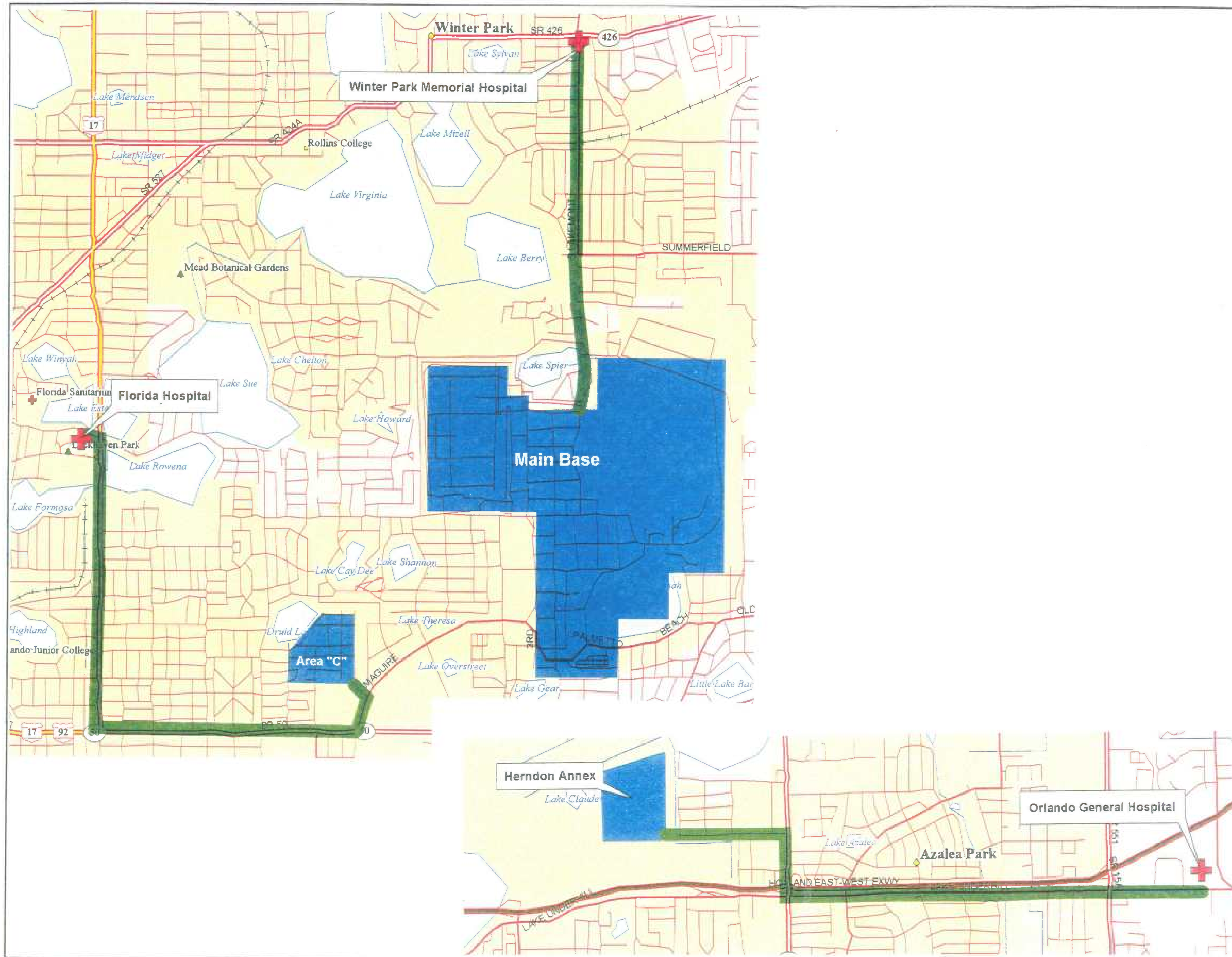
The primary source of medical assistance for Herndon Annex is the following:

Facility Name: Orlando General Hospital

Address: 7727 Lake Underhill Road, Orlando, FL

Telephone Number: (407 277-8110; Emergency (407) 275-5150

Directions to primary source of medical assistance from Herndon Annex (Figure 8-1):



Winter Park Memorial Hospital
Primary Hospital - Main Base

From project site leave Main Base going north through the North Gate. Continue north on Lakemont Avenue for about 1.7 miles. The hospital is on the right between the intersection of Mizell Avenue and Aloma Avenue.

Florida Hospital
Primary Hospital - Area "C"

From project site leave Area "C" and turn right onto Maguire. Continue to Colonial Drive (Sr 50). Turn right (west) and continue to Mills Avenue (Highway 17/92). Turn right (north) to Rollins Street. The Florida Hospital is on the left (west) side of Mills Avenue, at the intersection with Rollins Street.

Orlando General Hospital
Primary Hospital - Herndon Annex

From project site leave Herndon Annex going east on Kalmia to Semoran Boulevard. Take a right (south) at Semoran Boulevard. Continue to the Lake Underhill Road intersection and turn left (east, just past the East-West Expressway overpass). Continue for about 1.8 miles to the hospital on the left, which is between the intersections of Goldenrod Road and Chickasaw Trail.

FIGURE 8-1
MAIN BASE, AREA "C", AND HERNDON ANNEX PRIMARY HOSPITAL ROUTES

PROJECT OPERATIONS PLAN, HEALTH AND SAFETY PLAN

NAVAL TRAINING CENTER ORLANDO, FLORIDA

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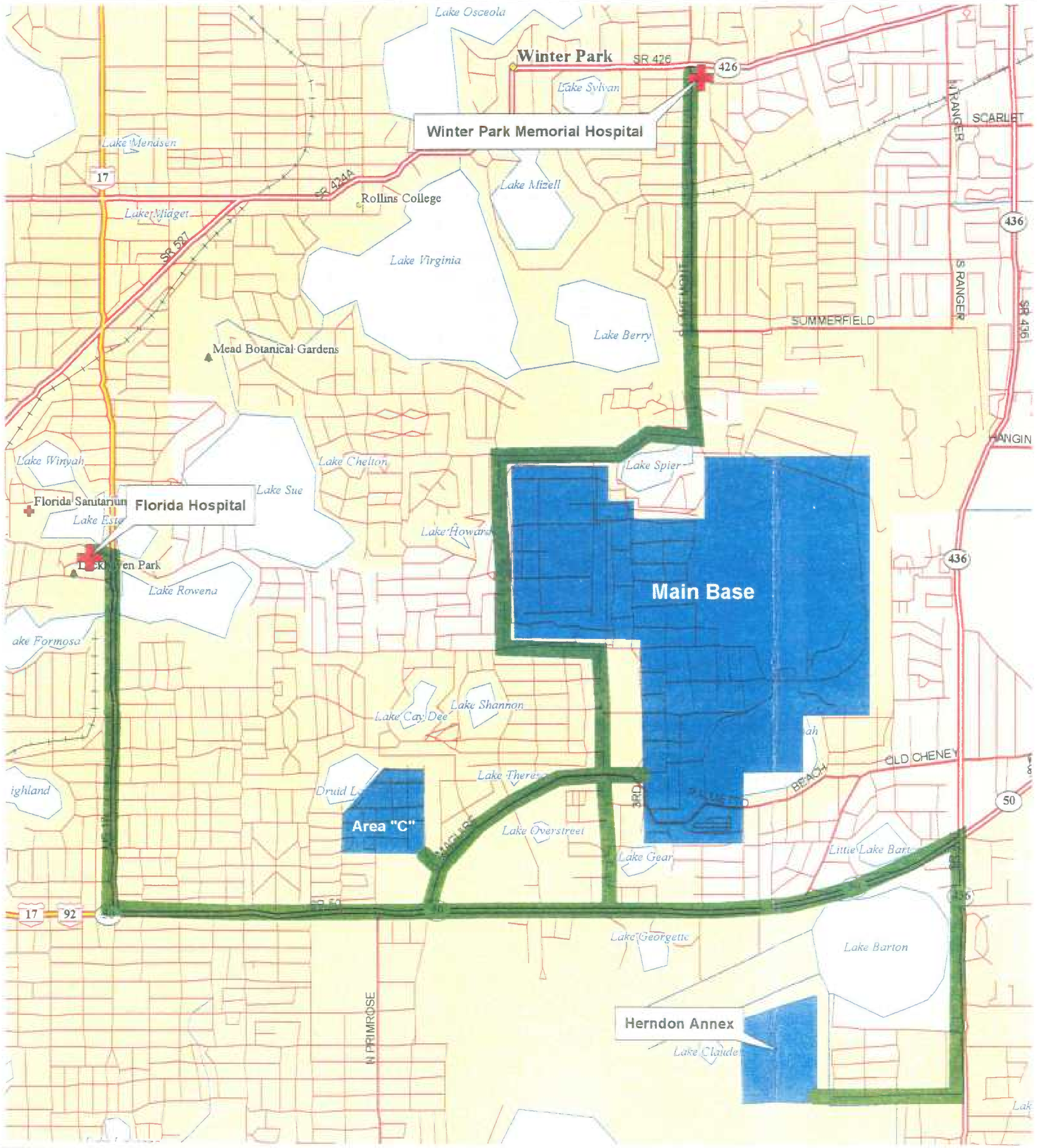

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Florida Hospital
Secondary Hospital - Main Base

From project site leave Main Base through the Maguire Gate. Continue on Maguire Boulevard to the Colonial Drive (SR 50) intersection. Turn right (west) and continue to the Mills Avenue intersection. Turn right (north) and continue about 1.4 miles to Rollins Street. The hospital is on the left (west).

Winter Park Memorial Hospital
Secondary Hospital - Area "C"

From project site leave Area "C" and turn right onto Maguire. Continue to the Colonial Drive (Sr 50) intersection. Turn left (east) and continue until the Bennet Road intersection. Turn left (north) and continue until Corrine Drive and turn left (west). Continue on Corrine Drive and turn right (east) at Glenridge Way. Follow Glenridge and turn left (north) at Lakemont Avenue. Continue north on Lakemont Avenue for about 1.7 miles. The hospital is on the right between the intersection of Mizell Avenue and Aloma Avenue.

Florida Hospital
Secondary Hospital - Herndon Annex

From project site leave Herndon Annex going east on Kalmia. Take a left (north) onto Semoran Boulevard (SR 436) and continue to the Mills Avenue intersection. Turn right (north) and continue about 1.4 miles to Rollins Street. The hospital is on the left (west).

FIGURE 8-3
MAIN BASE, AREA "C", AND HERNDON ANNEX SECONDARY HOSPITAL ROUTES

PROJECT OPERATIONS PLAN, HEALTH AND SAFETY PLAN

NAVAL TRAINING CENTER ORLANDO, FLORIDA

From project site, leave Herndon Annex going east on Kalmia to Semoran Boulevard. Take a right (south) at Semoran Boulevard. Continue to the Lake Underhill Road intersection and turn left (east, just past the East-West Expressway overpass). Continue for about 1.8 miles to the hospital on the left, which is between the intersections of Goldenrod Road and Chickasaw Trail.

The primary source of medical assistance for McCoy Annex is the following:

Facility Name: Orlando Regional Medical Center

Address: 1414 Kuhl Avenue, Orlando, FL

Telephone Number: (407) 841-5111; Emergency (407) 841-5111

Directions to primary source of medical assistance from McCoy Annex (Figure 8-2):

From project site, leave McCoy Annex through the north Daetwyler Drive entrance. Turn left (west) on the frontage road (McCoy Road) along the Beeline Expressway and continue to the South Orange Avenue intersection. Turn right (north) and continue for about 5.4 miles to the hospital on the left, which is between the side roads of Sturtevant and Underwood Streets. Kuhl Avenue is behind the hospital.

Alternate source of medical assistance for Main Base and Herndon Annex is the following:

Facility Name: Florida Hospital

Address: 601 E. Rollins Street, Orlando, FL

Telephone Number: (407) 896-6611; Emergency (407) 897-1940

Directions to alternate source of medical assistance from Main Base (Figure 8-3):

From project site, leave Main Base through the Maguire Gate. Continue on Maguire Boulevard to the Colonial Drive (SR 50) intersection. Turn right (west) and continue to the Mills Avenue intersection. Turn right (north) and continue about 1.4 miles to Rollins Street. The hospital is on the left (west).

Directions to alternate source of medical assistance from Herndon Annex (Figure 8-3):

From project site, leave Herndon Annex going east on Kalmia. Take a left (north) onto Semoran Boulevard (SR 436) and continue to the Colonial Drive (SR 50) intersection. Turn left (west) and continue to the Mills Avenue intersection.

Turn right (north) and continue about 1.4 miles to Rollins Street. The hospital is on the left (west).

The alternate source of medical assistance for Area C is the following:

Facility Name: Winter Park Memorial Hospital

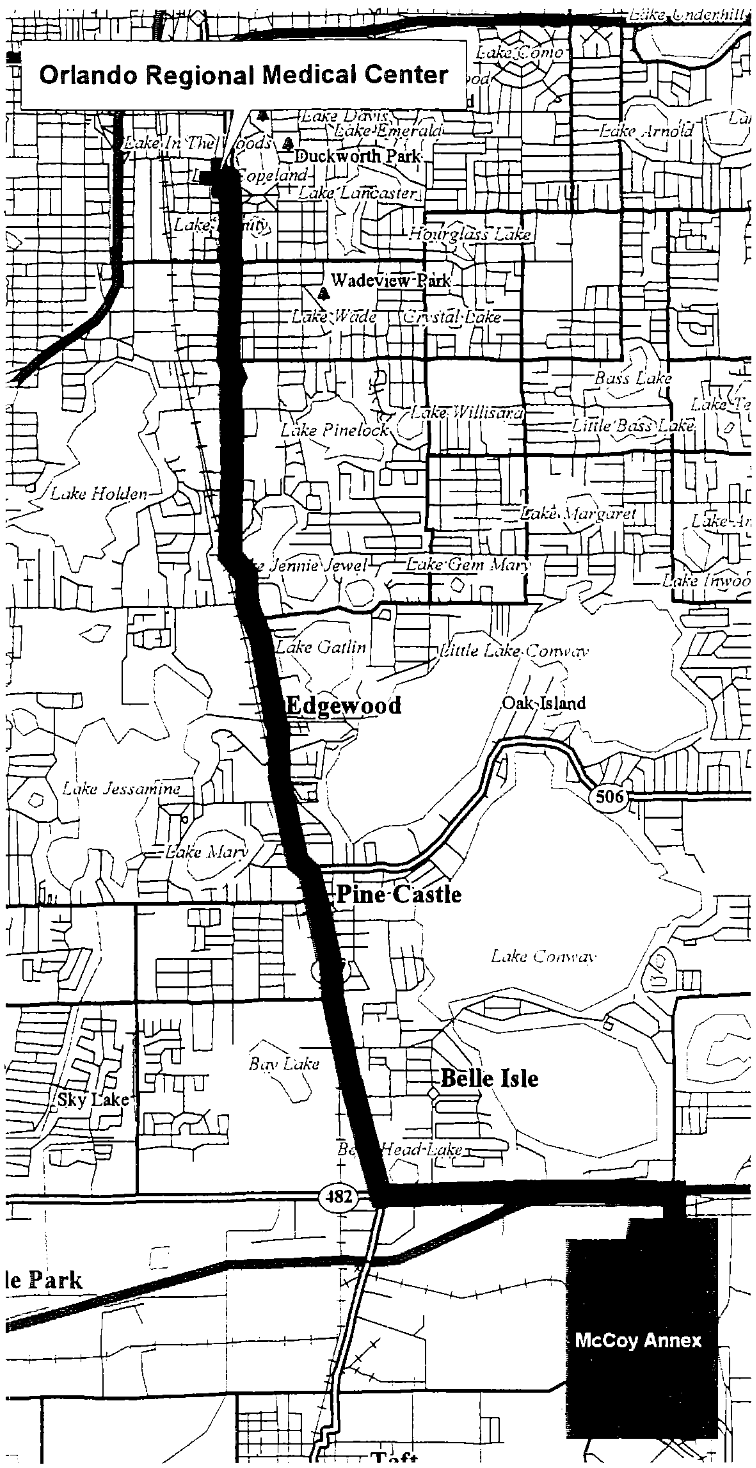
Address: 200 Lakemont Avenue, Winter Park, FL

Telephone Number: (407) 646-7000; Emergency (407) 646-7320

Directions to alternate source of medical assistance from Area C (Figure A-3):

From project site, leave Area C and turn right onto Maguire. Continue to the Colonial Drive (SR 50) intersection. Turn left (east) and continue until the Bennet Road intersection. Turn left (north) and continue until Corrine Drive and turn left (west). Continue on Corrine Drive and turn right (east) at Glenridge Way. Follow Glenridge and turn left (north) at Lakemont Avenue. Continue north on Lakemont Avenue for about 1.7 miles. The hospital is on the right between the intersections of Mizell Avenue and Aloma Avenue.

There is no alternate source of medical assistance for McCoy Annex within 10 miles.



Orlando Regional Medical Center Primary Hospital McCoy Annex

From project site leave McCoy Annex through the north Daetwyler Drive entrance. Turn left (west) on the frontage road (McCoy Road) along the Bee-Line Expressway and continue to the South Orange Avenue intersection. Turn right (north) and continue for about 5.4 miles to the hospital on the left, which is between the side roads of Sturtevant and Underwood Streets. Kuhl Avenue is behind the hospital.

FIGURE 8-2
McCOY ANNEX
PRIMARY HOSPITAL ROUTE

PROJECT OPERATIONS PLAN, HEALTH AND SAFETY PLAN

NAVAL TRAINING CENTER ORLANDO, FLORIDA

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ATTACHMENT A

SITE-SPECIFIC HEALTH AND SAFETY PLAN ADDENDUM

2.0 SITE CHARACTERIZATION AND ANALYSIS

2.1 SITE NAME, LOCATION, AND SIZE

2.2 SITE HISTORY AND LAYOUT

2.3 SCOPE OF WORK (WORKPLAN)

(include key project personnel including FOL, HSO)

3.0 TASK ANALYSIS

3.1 TASK ONE

3.1.1 Hazardous Substances

The materials identified are those known or suspected to be present onsite, along with any established exposure limits for those substances (in table form if possible).

3.1.2 Site Risks

Chemical hazards include (list all that apply and attach CHRIS sheets).

Safety hazards include (list all that apply) heavy equipment, excavation, buried utilities, noise, slips, trips, and falls, heat stress, lifting, biological hazards, water hazards, radiological hazards.

3.1.2.1 Health Hazards.

3.1.2.2 Safety Hazards.

3.1.2.3 Conclusion/Risk Assessment.

3.1.3 Protective Measures

3.1.3.1 Engineering Controls.

3.1.3.2 Levels of Protection.

3.1.4 Monitoring

Monitoring of the work environment will be undertaken to ensure that Immediately Dangerous to Life or Health (IDLH) or other dangerous conditions are identified. At a minimum, this monitoring will include evaluations for combustible atmospheres, oxygen-deficient environments, hazardous concentrations of airborne contaminants, and radioactivity.

3.1.4.1 Air Sampling. To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading the levels of protection in conformance with action levels provided in this HASP and at the direction of the site HSO.

The following sampling equipment will be used at the site. Refer to Appendix F for information on the calibration and maintenance of the equipment.

1.

2.

3.

4.

5.

3.1.4.2 Personal Monitoring. Personal monitoring will be undertaken to characterize the personal exposure of high-risk employees to the hazardous substances they may encounter onsite. Personal monitoring will be conducted on a representative basis. Personnel who are represented by the sampling will be noted in field logs.

The following personal monitoring equipment will be used at the site. Refer to Appendix F for information on the maintenance and calibration of the equipment.

1.

2.

3.

4.

5.

3.N TASK N (repeat for as many tasks as needed).

HEALTH AND SAFETY PLAN

PART II

APPENDICES

HEALTH AND SAFETY PLAN
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APPENDIX A AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL

A AUTHORITY AND RESPONSIBILITY OF HEALTH AND SAFETY PERSONNEL

This section describes the health and safety designations and general responsibilities that will be employed for the project.

A.1 HEALTH AND SAFETY MANAGER

The Health and Safety Manager (HSM), ABB Environmental Services, Inc. (ABB Environmental), can be reached by telephone at (207) 775-5401 in Portland, Maine. The HSM has final authority over health and safety issues that are not resolved at the site or through the Health and Safety Supervisor (HSS), and has overall responsibility for ensuring that the policies and procedures of this Health and Safety Plan (HASP) are implemented by the Health and Safety Officer (HSO). In the various regions, the HSM may delegate additional functions to the Regional HSS.

A.2 HEALTH AND SAFETY SUPERVISOR

The HSS is the health and safety professional serving as the ABB Environmental HSM's designee for this project. As such, the HSS will be responsible for (1) approval of the individual chosen to serve as the site HSO for this field operation; (2) review and approval of site-specific HASPs developed by the HSO, as well as any significant changes made over time to the site HASP; (3) oversight of the daily efforts of the HSO; (4) resolution of site disputes involving health and safety issues; and (5) implementation of the HASP by the HSO. The HSS will notify the HSM of any Stop Work Orders issued by an HSO.

APPENDIX B TRAINING PROGRAM

B TRAINING PROGRAM

All personnel working on an ABB Environmental site who potentially may be exposed to toxic substances or hazardous materials will participate in an initial and an annual refresher and/or supervisory training (as appropriate), as well as site-specific training before commencement of the on-site assignment. The initial Health and Safety Training Program consists of the 40-hour training program required and designated by the Occupational Safety and Health Administration (OSHA) standard 29 CFR 1910.120. In addition to the initial training, ABB Environmental uses 8-hour annual refresher and supervisory training elements, which are augmented by site-specific training regarding site hazards and specialized problems and protocols.

B.1 INITIAL TRAINING

All site-assigned personnel who are potentially exposed to toxic substances or hazardous materials will be required to participate in a training course on hazardous waste site operations. This training is required under provisions of the OSHA standard, and must consist of 40 hours covering the following areas:

- familiarity with the regulations and implications of OSHA regulations in 29 CFR 1910.120
- familiarity with the organizational structure responsible for site health and safety
- explanation of the medial surveillance requirements, including recognition of health hazards
- instruction in the use and maintenance of personal protective equipment
- identification and analysis of site chemical and physical hazards
- instruction regarding monitoring equipment, including personnel and environmental sampling instruments

- site control and decontamination procedures
- contingency planning
- confined-space entry procedures

B.2 Annual Refresher/Supervisory Training

Annually, all personnel required to participate in the initial training will take an 8-hour refresher training course. Those personnel with either site supervisory or health and safety responsibilities will also have an additional 8 hours of training beyond the initial 40 hours. The 8-hour supervisory training meets requirements of the annual refresher.

B.3 Site-Specific Training

All personnel assigned to an ABB Environmental site must participate in the site-specific training presentation, which will cover major elements of the site HASP, as well as health and safety procedures regarding an individual's specific job responsibilities and tasks. The site HSO or health and safety designee will provide this training before an individual is permitted to work in a downrange position.

B.4 Other Training

Additional training will be provided as determined by the HSM or the HSS, and may include additional refreshers on personal protective equipment, instrumentation, CPR, first aid, or any other pertinent health- or safety-related subject.

APPENDIX C MEDICAL SURVEILLANCE PROGRAM

C MEDICAL SURVEILLANCE PROGRAM

C.1 HEALTH MONITORING PROGRAM

All on-site ABB Environmental personnel and laboratory staff must be enrolled in the Health Monitoring Program, which is implemented through Health Resources, Inc., a company consisting of a team of physicians and support personnel who specialize in occupational medicine. The health monitoring program consists of an initial medical examination to establish the employee's general health profile, which provides important baseline laboratory data for later comparative study and annual examinations. The contents of the initial comprehensive physical examination and laboratory testing routine are listed in Table C-1. Follow-up examinations are completed annually for all personnel enrolled in the health monitoring program, or more frequently if project assignments warrant testing following specific field activities.

C.2 REVIEW OF EXPOSURE SYMPTOMS

Symptoms of exposure to hazardous materials will be reviewed for each site to indicate to personnel the recognized signs of possible exposure to those materials. This information will be supplemented with a discussion of the need for objectivity in the personal health assessment to account for normal reaction to stressful situations. The HSO will watch for outward evidence of changes in worker health. Symptoms may include skin irritations, skin discoloration, eye irritation, muscular soreness, fatigue, nervousness or irritability, intolerance to heat or cold, or loss of appetite. Employees will routinely be asked to assess their general state of health during the project. Special medical monitoring may be identified for certain sites.

TABLE C-1
BASELINE HEALTH MONITORING PROGRAM

PHYSICAL EXAMINATION

medical history
medical examination
vision: - ~near/distant
- ~color
audiometry
radiology: PA/LAT
spirometry
electrocardiogram

LABORATORY ANALYSIS

Complete Blood Counts and Chemistries

white blood count
differential cell counts
methemoglobin
uric acid
lactic dehydrogenase
alkaline phosphatase
calcium
phosphorus
cholesterol
urea nitrogen
glucose
albumin
globulin
total protein
total bilirubin
serum glutamic oxalacetic transaminase
hemoglobin and/or hematocrit

Urine Analysis

- color and character
- specific gravity
- pH
- protein
- acetone
- glucose
- microscopic examination

Biotox Panel

APPENDIX D ENGINEERING CONTROLS

D ENGINEERING CONTROLS

Whenever feasible, engineering controls will be used at the site to reduce employee exposure to hazardous substances. Feasible engineering controls include the following:

- the use of pressurized cabs or control booths
- the use of remotely operated materials-handling equipment
- the use of industrial-sized fans to blow hazardous vapors from the breathing zone when exposure is from a point source and a power source is available

APPENDIX E PERSONAL PROTECTIVE EQUIPMENT

E PERSONAL PROTECTIVE EQUIPMENT

E.1 PERSONAL PROTECTION LEVEL DETERMINATION

The level of personal protective equipment required will be determined by the type and levels of waste or spill material present at the site where project personnel may be exposed. In situations where the types of waste or spill material on-site are unknown, the hazards are not clearly established, or the situation changes during on-site activities, the HSO must make a reasonable determination of the level of protection that will ensure the safety of investigators and response personnel until potential hazards have been determined through monitoring, sampling, informational assessment, laboratory analyses, or other reliable methods. Once the hazards have been determined, protective levels commensurate with the hazards will be used. Protection requirements will be evaluated on a continuous basis to reflect new information as it is acquired.

E.2 LEVELS OF PROTECTION

The following subsections describe the basic composition of the generally recognized protective ensembles to be used for site operations. Specific components for any level of protection will be selected based on hazard assessment; additional elements will be added as necessary. Disposable protective clothing, gloves, and other equipment, exclusive of respirators, should be used when feasible to minimize risks during decontamination and possible cross-contamination during sample handling.

E.2.1 Level A

Level A protection provides the highest level of protection for skin, eyes, and the respiratory system. It is appropriate for conditions where there are potential or actual high concentrations of atmospheric vapors, gases, or particulates. Level A should be used if site operations or work functions involve a high potential for splash, immersion, or exposure to unexpected vapors, gases, or particulates of materials that are harmful to the skin or capable of being absorbed through the intact skin. Level A is used primarily for emergency situations or when the following conditions exist: (1) vapors or mists of strong acids; (2) known or probable immediately dangerous to life and health (IDLH) atmospheres with dermally active compounds; (3) high atmospheric concentrations of compounds that can be absorbed through the skin; and (4) operations that must be conducted in a confined, poorly ventilated area, where conditions requiring Level A have not yet been eliminated. The fully encapsulating suit and the pressure-demand self-contained breathing apparatus (SCBA) or hoseline respirator are the key elements in Level A personal protective equipment (PPE).

Level A equipment includes the following items:

- SCBA (pressure demand) OR supplied air respirator (pressure demand with escape mask)
- total encapsulating suit
- coveralls (optional)
- long underwear
- gloves (outer, chemical-resistant)
- gloves (inner, chemical-resistant)
- boots (chemical-resistant, steel-toed, steel shank)
- hardhat (optional)
- disposable protective suit, gloves, and boots (to be worn over or under encapsulating suit)
- two-way radios

E.2.2 Level B

Level B protection should be used when the type and atmospheric concentration of substances have been identified and require a high level of respiratory protection; however, the atmospheric contaminant, splashing liquid, or other direct contact will not adversely affect or be absorbed through any exposed skin. This includes atmospheres with IDLH concentrations of specific substances that do not (1) represent a severe skin hazard, or (2) meet the criteria for use of air-purifying respirators. Level B has the same respiratory protection criteria as Level A; however, dermal exposure is not as severe.

Level B equipment includes the following items:

- SCBA (pressure demand) OR supplied air respirator (pressure demand with escape SCBA)
- hooded chemical-resistant clothing (coated Tyvek)
- coveralls (optional)
- gloves (outer, chemical-resistant)
- gloves (inner, chemical-resistant)
- boots (chemical-resistant, steel-toed, steel shank)
- boot covers (chemical-resistant) (optional)
- hardhat (optional)
- two-way radio (to be worn under outside protective clothing)
- face shield (optional)

E.2.3 Level C

Level C protection should be used when the atmospheric contaminant, liquid splashes, or other direct contact will not adversely affect or be absorbed through any exposed skin. In addition, the types of air contaminants must have been identified, the concentration measured, and an air-purifying respirator must be available that can remove the contaminants. An air-purifying respirator can only be used if the oxygen content in the air is at least 19.5 percent, the contaminant has adequate warning properties (e.g., odor, taste, and irritating effect thresholds within two times the Threshold Limit Value), the concentration of the contaminant does not exceed the IDLH, and the worker has been fit-tested. Level C has the same splash protection as Level B; however, cartridge respirators are used instead of SCBAs.

Level C equipment includes the following items:

- full-face respirator (cartridge)
- hooded chemical-resistant clothing (coated Tyvek)
- coveralls (optional)
- gloves (inner, chemical-resistant)
- gloves (outer, chemical-resistant)
- boots (chemical-resistant, steel-toed, steel shank)
- boot covers (chemical-resistant) (optional)
- hardhat (optional)
- escape mask (optional)
- two-way radios (worn under outside protective clothing)
- face shield (optional)

E.2.4 Level D

Level D is a work uniform affording minimal protection and is used for nuisance contaminants only. Level D protection should only be used when the atmosphere contains no known hazard, all potential airborne contaminants can be monitored for, and work functions preclude splash, immersion, or the potential for unexpected inhalation or contact with hazardous levels of any chemical.

Level D equipment includes the following items:

- coveralls
- gloves (optional)

- boots (chemical-resistant, steel-toed, steel shank)
- boot covers (chemical-resistant) (optional)
- safety glasses or chemical splash goggles (optional)
- hardhat (optional)
- escape mask (optional)
- face shield (optional)

APPENDIX F MONITORING EQUIPMENT

F MONITORING EQUIPMENT

The work environment will be monitored to ensure that IDLH or other dangerous conditions are identified. At a minimum, monitoring will include evaluations for combustible atmospheres, oxygen-deficient environments, hazardous concentrations of airborne contaminants, and radioactivity.

F.1 AIR SAMPLING: EQUIPMENT, CALIBRATION AND MAINTENANCE

To the extent feasible, the presence of airborne contaminants will be evaluated through the use of direct-reading instrumentation. Information gathered will be used to ensure the adequacy of the levels of protection being used at the site, and may be used as the basis for upgrading or downgrading levels of protection, at the discretion of the site HSO.

F.1.1 ISC MX-241 Dual Detector

This meter monitors for combustible gases and oxygen. It can be used to determine (1) if an area contains concentrations of combustible gases with readings in percentage of the lower explosive limit (LEL); and (2) the percentage of oxygen. This equipment will be calibrated in accordance with the manufacturer's instructions.

This instrument also is calibrated to methane and monitors combustible gases in the percentage of the lower explosive limit. It will be calibrated in accordance with the manufacturer's instructions.

F.1.2 ISD HS267

This instrument monitors for the presence of hydrogen sulfide in parts per million (ppm). It will be calibrated in accordance with the manufacturer's instructions.

F.1.3 Photovac Organic Vapor Analyzer 10S50

The Organic Vapor Analyzer (OVA) is a total organic vapor analyzer capable of detecting volatile organic compounds (VOCs) that can be ionized by ultraviolet (UV) light. Model 10S50 is commonly used on-site to estimate the presence of VOCs for purposes of crew protection, well screen placement, and selection of samples for further analysis. The principle of operation is twofold: (1) the ambient temperature gas chromatograph, which breaks down mixtures of VOCs into individual components identified by retention time; and (2) detection accomplished by ionization in UV light. The charged component then moves to an electrode which, in turn, results in a meter deflection proportional to the concentration of the contaminant. This instrument does not read out directly in ppm unless calibrated against the material being measured; therefore, results must be interpreted conservatively and with care. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

F.1.4 HNU IS101 and Photovac TIP Photoionization Detector

Like the OVA, the photoionization detector (PID) operates on the basis of ionization of the contaminant, which results in a meter deflection proportional to the concentration of the contaminant. In the PID, ionization is caused by a UV light source. The strength of the UV, measured in electron volts (eV), determines which contaminants can be ionized. The HNU can use three different-strength UV sources, including 9.6, 10.2, and 11.7 eV; only the 10.2- and 11.7-eV probes are currently available for field use. The TIP operates using a UV light source of 10.6 eV. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

F.1.5 Detector Tubes (MSA and Draeger)

A colorimetric detector tube is a direct-reading instrument consisting of a glass tube impregnated with an indicating chemical, which is connected to a piston cylinder or bellows-type pump. A known volume of air is drawn through the glass tube. The contaminant in the air reacts with the indicator chemical, producing a stain the length of which is proportional to the contaminant's concentration. Care must be taken when using the detector tubes because reliability of the results depends on the proper pump calibration, the degree of stability of the reacting chemical, and the ambient temperature. Interfering gases or vapors can also positively or negatively affect measured results. Calibration and maintenance will be performed in accordance with the manufacturer's instructions.

F.2 PERSONAL MONITORING: EQUIPMENT, CALIBRATION AND MAINTENANCE

Personal monitoring will be undertaken to characterize exposure of high-risk employees to hazardous substances encountered on-site.

F.2.1 Personal Sampling Pumps

These devices can be worn by an employee to draw air samples through appropriate collection media. The units can be used to draw volumes from 2 to 3 liters per minute. Calibration will be conducted using standard industrial hygiene protocols before and after each sampling session (i.e., each day's use).

F.2.2 Passive Dosimeters or Gas Badges

These devices are nonmechanical collection devices used to monitor for organic vapors and various gases. The device is worn by an employee and then sent to an industrial hygiene laboratory for analysis.

F.2.3 Thermoluminescent Dosimetry Body Badges

These devices are nonmechanical collection devices used to monitor for x-ray, beta, and gamma radiation exposure. The badges are worn by ABB Environmental employees and sent quarterly to Tech/Ops Landauer, Inc., for analysis.

APPENDIX G ZONATION

G ZONATION

The site itself will normally be divided into three zones: (1) the majority of the work area, considered the Exclusion Zone; (2) limited areas serving as the Support Zone; and (3) an area for decontamination called the Contamination Reduction Zone (CRZ).

G.1 EXCLUSION ZONE

The Exclusion Zone isolates the area of contaminant generation and restricts (to the extent possible) the spread of contamination from active areas of the site to support areas and off-site locations. The Exclusion Zone is demarcated by the Hot Line (i.e., a tape line or physical barrier). Personnel entering the Exclusion Zone must (1) enter through the CRZ; (2) wear the prescribed level of protection; and (3) be otherwise authorized to enter the Exclusion Zone. Any personnel, equipment, or materials exiting the Exclusion Zone will be considered contaminated. Personnel will be subject to decontamination; equipment and materials will either be subject to decontamination or containerized in uncontaminated devices.

Within the Exclusion Zone, specific locations or restricted areas (clearly marked or identified) will be established (as necessary) for particular locations or around specific site operations. In the case of well drilling or excavation operations, a restricted area will be established that includes a minimum 30-foot radius from the drill rig or excavation operation. Other restricted areas may include drum areas, active site areas, sources of combustible gases or air contaminants, or other dangerous areas as they are identified. Access for emergency services to areas of specific site operations will be established.

G.2 CONTAMINATION REDUCTION ZONE

Moving out from the Exclusion Zone, starting at the Hot Line and continuing to the Contamination Control Line, is the CRZ. The CRZ is a transition zone between contaminated and uncontaminated areas of the site. When "hot" or contaminated personnel, equipment, or materials cross the Hot Line, they are assumed to be as hot or contaminated as they are going to be from site operations. Being subjected to the decontamination process, they become less contaminated; when they reach the Contamination Control Line, they are clean and can exit the CRZ without spreading contamination.

Within the CRZ is the Contamination Reduction Corridor, where materials necessary for full personnel and portable equipment decontamination are kept. A separate facility will be established for heavy equipment decontamination. In addition, certain safety equipment (e.g., emergency eye wash, fire extinguisher, stretcher, and first aid kit) are staged in this zone.

G.3 SUPPORT ZONE

The Support Zone is the outermost zone of the site, separated from the CRZ by the Contamination Control Line; it is considered a clean area. Movement of personnel and materials from the Support Zone into the CRZ is generally unrestricted, except as required through access points controlled for administrative purposes. However, only uncontaminated/decontaminated personnel or materials may enter the Support Zone from the CRZ.

The Support Zone contains the necessary support facilities (including personal hygiene facilities) for site operations. It also serves as the communications center and source of emergency assistance for operations in the Exclusion Zone and CRZ. A log of all persons entering the site will be maintained by the HSO, the field operations leader, or the site designee.

APPENDIX H WORK PRACTICES

H WORK PRACTICES

H.1 GENERAL

Workers will be expected to adhere to the established safe work practices for their respective specialties (e.g.,drilling, laboratory analysis, and construction). The need to exercise caution in the performance of specific work tasks is made more acute due to (1) weather conditions; (2) restricted mobility and reduced peripheral vision caused by the protective gear itself; (3) the need to maintain integrity of the protective gear; and (4) the increased difficulty in communicating caused by respirators. Work at the site will be conducted according to established protocol and guidelines for the safety and health of all involved. Among the most important of these principles for working at a hazardous waste site are the following:

- In any unknown situation, always assume the worst conditions and plan responses accordingly.

- Use the buddy system. Under no conditions will any person be permitted to enter the Exclusion Zone alone. Establish and maintain communications. In addition to radio communications, it is advisable to develop a set of hand signals, because conditions may greatly impair verbal communications.

- Because no personal protective equipment is 100 percent effective, all personnel must minimize contact with excavated or contaminated materials. Plan work areas, decontamination areas, and procedures accordingly. Do not place equipment or drums on the ground. Do not sit on drums or other materials. Do not sit or kneel on the ground in the Exclusion Zone or CRZ. Avoid standing in or walking through puddles or stained soil.

- Disposable items will be used, when possible, to minimize risks during decontamination and possible cross-contamination during sample-handling.

- Smoking, eating, or drinking in the work area and before decontamination will not be allowed. Oral ingestion of contaminants is a likely means of introducing toxic substances into the body.

- Avoid heat and other work stresses related to wearing protective gear. Work breaks should be planned to prevent stress-related accidents or fatigue.

- Maintain monitoring systems. Conditions can change quickly if subsurface areas of contamination are penetrated.

- Conflicting situations that may arise concerning safety requirements and working conditions must be addressed and resolved rapidly by the HSO to avoid any motivation or pressure to circumvent established safety policy.

- To the extent feasible, handling of contaminated materials should be done in a remote area, particularly when drummed or other containerized hazardous waste materials are found on-site. Every effort should be made to identify the contents of containers found on-site before they are subject to material-handling applications.

- Personnel must be observant of not only their own immediate surroundings but also that of others. Everyone will be working under constraints; therefore, a team effort is needed to notice and warn of impending dangerous situations. Extra precautions are necessary when working near heavy equipment while using personnel protective gear because vision, hearing, and communication can be restricted.

- Contact lenses may be allowed to be worn on-site, unless one of the following chemicals is present or suspected: acrylonitrile, ethylene oxide, methylenedianiline, or 1,2-dibromo-3-chloropropane. The wearer must have an extra pair of lenses or prescription glasses available on-site.

- Contact lenses may also be worn with respirators, provided 1) none of the chemicals listed above are present, and 2) the wearer has tried the respirator with contacts in a non-hazardous environment first, and experienced no difficulties.

- All facial hair that interferes with the face piece fit must be removed before donning a respirator at all sites requiring Level C or Level B protection.

- Rigorous contingency planning and dissemination of plans to all personnel minimizes the impact of rapidly changing safety protocols in response to changing site conditions.

- Personnel must be aware that chemical contaminants may mimic or enhance symptoms of other illnesses or intoxication. Avoid excess use of alcohol or working while ill during field investigation assignments.

- The site leader, HSO, and sampling personnel will maintain project records in a bound notebook (e.g., daily activities, meetings, incidents, and data). Notebooks will remain on-site for the project duration so that replacement personnel may add information, thereby maintaining continuity. The notebooks and daily records will become part of the permanent project file.

H.2 Site Entry Procedures

In most cases, ABB Environmental teams are not the first on-site investigators. Considerable knowledge of site history and current status allows preparation of a HASP with reasonable assurance that personnel are adequately protected. In the event that sufficient site information is not available to perform a summary risk assessment and assign the appropriate level of personal protective equipment, the following procedures should be followed. It must be understood that verification of the level of contamination (even with background information) will always require some of the following steps.

1. Recognize that ABB Environmental's presence on-site implies a perceived contamination potential by the client.

2. Assume that the site is contaminated and conduct a site safety reconnaissance, consisting of the following activities:

    - Establish a CRZ (decontamination area).

    - Survey the site at the highest level of protection practicable, beginning with a perimeter survey and gradually covering all areas of proposed activity with the following (as appropriate):

- HNU PI meter or equivalent
- OVA
- radiation survey meter
- personal air sampling pumps
- chemically reactive indicator tubes
- oxygen-deficiency meter
- explosive mixture meter

- Establish a "hot zone."

- Review data, assess risk, and select the appropriate level of protection.

3. Prepare a summary site HASP and document all data acquired.

APPENDIX I PERMIT-REQUIRED CONFINED SPACES

I PERMIT-REQUIRED CONFINED SPACES

I.1 INTRODUCTION

A worker entering a confined space can be exposed to multiple hazards if conditions are not understood or safety regulations are not enforced. Most accidents result from failure of workers to recognize a confined space as a potential hazard. Ignorance and negligence have led to a number of deaths each year by asphyxiation, fire and explosion, and/or fatal exposure to toxic materials (Table I-1). Because of this, OSHA developed the Permit-Required Confined Spaces Standard (29 CFR 1910.146).

ABB-ES associates may encounter a variety of confined spaces when working at hazardous waste sites. As the confined spaces found at hazardous waste sites are typically unknown and usually require only a single entry, all spaces will be considered permit-required unless otherwise allowed by the Health and Safety Manager (HSM).

Before entry into a confined space is permitted, the Health and Safety Officer (HSO) will ensure that the Health and Safety Plan (HASP) addresses the entry and that the entry permit has been issued. Items that will be addressed in the HASP and/or the Permit will include the following:

- Measures to use to prevent unauthorized entry.
- Identification and evaluation of the hazards.
- Means, procedures, and practices necessary for safe entry.
- Availability and proper use of required equipment.
- Procedures to determine if acceptable entry conditions exist and that they are maintained before and during entry.
- Testing or monitoring of space to ensure acceptable conditions are maintained.

TABLE I-1
ACCIDENTS AND ILLNESS TYPE
CONFINED SPACE (CS)

REF. No.	ACCIDENT AND ILLNESS TYPE	EVENTS	INJURIES	FATALITIES
1	Atmospheric Condition in CS	80	72	78
2	Explosion or Fire in CS	15	49	15
3	Explosion or Fire at Point-of-Entry to CS	23	20	32
4	Electrocution or Electrical Shock	11	2	9
5	Caught In/Crushing of CS	10	3	10
6	Trapped in Unstable Materials in CS	16	0	16
7	Struck by Falling Objects in CS	15	1	14
8	Falls (while in CS; not into CS)	27	26	1
9	Ingress/Egress of CS	33	30	3
10	Insufficient Maneuverability in CS	15	15	0
11	Eye Injury in CS	10	10	0
12	Contact with Temperature Extreme in CS	7	4	3
13	Noise in CS	1	1	0
14	Vibration in CS	1	1	0
15	Stress from Excess Exertion in CS	12	0	12
Totals		276	234	193

Safety Sciences, San Diego, California - 1977 [1]

- Identification of associates with active roles such as authorized entrants, attendants, entry supervisor, and rescue including assignment of duties.
- Training
- Rescue procedures
- Permit preparation, issuance, use, and cancellation.
- Coordination of entry with subcontractor.
- Review of entry operations

I.2 Measures to Prevent Unauthorized Entry

Depending on site conditions, the actual confined space plus a suitable area around the entrance will be considered the Exclusion Zone. Only those who meet the training requirements of The Hazardous Waste Operations and Emergency Response Standard (29 CFR 1910.120) and the Permit-Required Confined Spaces (29 CFR 1910.146) will be allowed in this area.

The perimeter of the Exclusion Zone will be identified by flagging or some other method The actual confined space will remain sealed, locked, or otherwise protected until authorization for entry is given. If the entryway into the confined space cannot be protected from unauthorized entry, a sign stating **DANGER - PERMIT REQUIRED CONFINED SPACE, DO NOT ENTER** will be placed on or near the entry. It is the responsibility of the HSO to ensure that the above procedures are followed.

I.3 Identification and Evaluation of Hazards

When evaluating a confined space and determining its exposure potential, both physical and chemical hazards must be considered.

I.3.1 Physical Classification

Confined Spaces are defined as areas large enough and so configured that an employee can enter the space and perform assigned work, has limited or restricted access, and is not designed for continuous occupancy. Confined spaces can be categorized generally as those with open tops and a depth that restricts the natural movement of air, and those with very limited openings for entry. In either case, the space may contain electrical or mechanical equipment with moving parts. Any combination of these parameters changes the nature of the hazards encountered. Degreasers, pits, and certain types of storage tanks may be classified as open-top confined spaces that usually contain no moving parts. However, gases that are heavier than air (i.e., butane, propane, and other hydrocarbons) remain in depressions and will flow to low points where they are difficult to remove. Open-top water tanks or test pits that appear harmless may develop toxic atmospheres (e.g., hydrogen sulfide or chlorinated hydrocarbons) from the vaporization of contaminated water or soil. Therefore, these heavier-than-air gases are a primary concern when entering such a confined space. Other hazards may develop due to the work performed in the confined space or corrosive residues that accelerate the decomposition of scaffolding supports and electrical components.

Confined spaces such as sewers, casings, tanks, silos, vaults, and compartments of ships usually have limited access. The problems associated with entry into these areas are similar to those that occur in open-top confined spaces. However, limited access increases the risk of injury. Heavier-than-air gases (e.g.,carbon dioxide and propane) may lie in a tank or vault for hours or even days after the container is opened. Because some gases are odorless, the hazard may be overlooked, with fatal results. Lighter-than-air gases may also be trapped within an enclosed-type confined space, especially those with access from the bottom or sides.

The most hazardous confined space is one that combines limited access and mechanical or electrical devices. All the hazards of open-top and limited-access confined spaces may be present, together with the additional hazard of moving parts. Digesters and boilers usually contain power-driven equipment which, unless properly isolated, may inadvertently be activated after entry. Such equipment may also contain physical hazards that further complicate the work environment and the entry and exit process.

I.3.1.1 Physical Hazards. Physical hazards that may be encountered in a confined space include non-chemical, physiologic stresses such as thermal effects (heat and cold), noise, vibration, radiation, and fatigue.

I.3.1.1.1 Thermal Effects

Four factors influence the interchange of heat between humans and the environment:

- air temperature
- air velocity
- moisture contained in the air
- radiant heat

Because of the nature and design of most confined spaces, moisture content and radiant heat are difficult to control. As the body temperature rises progressively, a worker continues to function until the body temperature reaches 38.3° to 39.4°C (101° to 103°F). When this body temperature is exceeded, the worker is less efficient, and is prone to heat exhaustion, heat cramps, or heat stroke. In a cold environment, certain physiologic mechanisms come into play that tend to limit heat loss and increase heat production. The most severe strain in cold conditions is the chilling of extremities so that activity is restricted. Special precautions must be taken in cold environments to prevent frostbite, trench foot, and general hypothermia.

I.3.1.1.2 Noise

Noise problems are usually intensified in confined spaces because the interior tends to cause sound to reverberate, thus exposing the worker to audio levels higher than in an open environment. Intensified noise increases the risk of hearing damage to workers, which could result in temporary or permanent hearing loss, and/or could cause disorientation and affect the workers' ability to function even to the extent that they are unable to escape from the space. Noise in a confined space that may not be intense enough to cause hearing damage may still disrupt verbal communication with the emergency standby person outside the confined space. If the workers inside cannot hear commands or danger signals due to excessive noise, the probability of severe accidents can increase.

I.3.1.1.3 Other Physical Hazards

Some physical hazards cannot be eliminated because of the nature of the confined space or the work to be performed, including items such as scaffolding, surface residues, and structural hazards. The use of scaffolding in confined spaces has contributed to many accidents caused by workers or materials falling, improper use of guardrails, and lack of maintenance to ensure worker safety. The choice of material used for scaffolding depends on the type of work to be performed, the calculated weight to be supported, the surface on which the scaffolding is placed, and the substance previously stored in the confined space.

Surface residues in confined spaces can increase the already hazardous conditions of electrical shock, reaction of incompatible materials, liberation of toxic substances, and bodily injury due to slips, trips, and falls. Without protective clothing, additional health hazards may arise due to surface residues.

Structural hazards within a confined space (e.g., baffles in horizontal tanks, trays in vertical towers, bends in tunnels, overhead structural members, or scaffolding installed for maintenance) constitute physical hazards that are exacerbated by the physical surroundings. In dealing with structural hazards, workers must review and enforce safety precautions to ensure safety.

Rescue procedures may require withdrawal of an injured or unconscious person. Careful planning must be given to the relationship between the internal structure, the exit opening, and the worker. Provisions must be made so the victim is positioned in front of the opening in such a configuration that he/she can be removed from the space. If the worker is above the opening, the system must include a rescue arrangement operated from outside the confined space, if possible, by which the worker can be lowered and removed without injury.

I.3.2 Chemical Classifications

Confined spaces are also classified according to existing or potential chemical hazards. The classification is based on characteristics of the confined space, oxygen level, flammability, and toxicity. Table I-2 defines the parameters of each classification. If any of the hazards present a situation that is Immediately Dangerous to Life and Health (IDLH), the confined space is designated as Class A and requires Level A or B personal protective equipment. The classification is determined by the most hazardous condition of entering, working in, and exiting a confined space. Class B confined spaces have the potential for causing injury and illness, but are not IDLH (Level B or C personal protective equipment). A Class C confined space is one in which the chemical hazard potential is minimal and does not require any special modification in work procedures (Level D personal protective equipment).

I.3.2.1 Hazardous Atmospheres. Hazardous atmospheres encountered in confined spaces can be divided into four categories: (1) oxygen-deficient, (2) flammable, (3) toxic, and (4) irritant and/or corrosive.

I.3.2.1.1 Oxygen-Deficient Atmosphere

The normal atmosphere is composed of approximately 20.9 percent oxygen, 78.1 percent nitrogen, and 1 percent argon, with small amounts of various other gases. Reduction of oxygen in a confined space may be the result of either consumption or displacement.

The consumption of oxygen occurs during combustion of flammable substances, as in welding, heating, cutting, and brazing. A more subtle consumption of oxygen occurs biologically (e.g., during the bacterial action of the fermentation process). Oxygen may also be consumed during chemical reactions (e.g., formation of rust [iron oxide] on the exposed surface of the confined space).

A second cause of oxygen deficiency is displacement by another gas. Helium, argon, and nitrogen are examples of gases that are intentionally used to displace air and which therefore reduce the oxygen level. Carbon dioxide may be intentionally introduced to displace air, but can also naturally

Table I-2
Confined Space Classification Table

PARAMETERS	CLASS A (LEVEL A OR B PPE)	CLASS B (LEVEL B OR C PPE)	CLASS C (LEVEL D PPE)
Characteristics	Immediately dangerous to life: rescue procedures require the entry of more than one individual fully equipped with life-support equipment; maintenance of communication requires an additional standby person stationed within the confined space.	Dangerous, but not immediately life-threatening: rescue procedures require the entry of no more than one individual fully equipped with life-support equipment; indirect visual or auditory communication with workers.	Potential hazard requires no modification of work procedures: standard rescue procedures, direct communication with workers from outside the confined space.
Oxygen	19.4 percent or less *(122-mm Hg) or greater than 23.5 percent *(190 mm Hg)	19.5 to 20.9 percent *(122- to 147-mm Hg) or 20.9 to 23.5 percent (163- to 190-mm Hg)	19.5 to 20.9 percent *(148- to 163-mm Hg)
Flammability Characteristics	20 percent or greater LEL	10 to 19 percent LEL	10-percent LEL or less
Toxicity	**IDLH	Between the TLV/PEL and the **IDLH. If air-purifying respirators are used, maximum level based on breakthrough time (1,000 ppm maximum).	Less than the TLV/PEL.
Respiratory Protection	SCBA or supplied air respirator with escape bottle.	SCBA, supplied air respirator with escape bottle or air-purifying respirator.	None.

* Based on total atmospheric pressure of 760-mm Hg (sea level).
** Immediately Dangerous to Life and Health, as referenced in NIOSH Registry of Toxic and Chemical Substances, Manufacturing Chemists data sheets, industrial hygiene guides, or other recognized authorities.

Notes: Hg = mercury; LEL = Lower Explosive Limit; PEL = Permissible Exposure Limit;
SCBA = Self-Contained Breathing Apparatus; TLV = Threshold Limit Value
PPE = Personal Protective Equipment

displace air (e.g., in sewers, storage bins, wells, tunnels, wine vats, and grain elevators).

I.3.2.1.2 Flammable Atmosphere

A flammable atmosphere generally arises from vaporization of flammable liquids, by-products of work, chemical reactions, enriched-oxygen atmospheres, concentrations of combustible dusts, and desorption of chemicals from inner surfaces of the confined space. An atmosphere becomes flammable when, in the presence of oxygen, the concentration is neither too rich nor too lean to burn. Combustible gases or vapors will accumulate when there is inadequate ventilation in an area (e.g., a confined space). Flammable gases (e.g., acetylene, butane, propane, hydrogen, methane, natural or manufactured gases, or vapors from liquid hydrocarbons) can be trapped in a confined space. Heavier-than-air gases will seek lower levels (as in pits, sewers, and various types of storage tanks and vessels). In a closed-top tank, lighter-than-air gases may rise and develop a flammable concentration if trapped at the top of the tank.

I.3.2.1.3 Toxic Atmosphere

The substances regarded as toxic in a confined space can cover the entire spectrum of gases, vapors, and finely divided airborne dust in industry. The forces of toxic atmospheres encountered may arise from the manufacturing process (e.g., in producing polyvinyl chloride, hydrogen chloride is used, as well as a vinyl chloride monomer, which is carcinogenic); the product stored (e.g., removing decomposed organic material from a tank can liberate toxic substances such as hydrogen sulfide); and the operation performed in the confined space (e.g., welding or brazing with metals capable of producing toxic fumes).

I.3.2.1.4 Irritant (Corrosive) Atmosphere

Irritant or corrosive atmospheres can be divided into primary and secondary groups. Primary irritants show responses at the point of contact and generally exert no systemic toxic effects. Examples of primary irritants are chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide, ammonia, and sulfur dioxide. A secondary irritant is one that may produce systemic toxic effects in addition to surface irritation; for example, benzene, carbon tetrachloride, ethyl chloride, 1,1,1-trichloroethane, trichloroethylene, and 3-chloropropylene.

Prolonged exposure to irritant or corrosive concentrations in a confined space may produce little or no evidence of irritation. This has been interpreted to mean that the worker has adapted to the harmful agent involved. In reality, it means there has been a general weakening of the body's defense reflexes due to damage of the nerve endings in the mucous membranes of the conjunctive and upper respiratory tract. The danger in this situation is that the worker is usually not aware of any decrease in his/her reaction to the toxic substance.

I.3.3 General Safety Hazards

I.3.3.1 Communication Problems. Communication between the worker inside a confined space and the standby person outside is of utmost importance. If the worker suddenly feels distressed and is not able to summon help, this condition could result in a fatality. Frequently, the body positions assumed in a confined space make it difficult for the standby person to detect an unconscious worker. When visual monitoring of the worker is not possible because of the design of the confined space or location of the entry hatch, a voice- or alarm-activated, explosion-proof-type communication system is necessary.

Suitable and approved illumination is required to provide sufficient visibility for work. Illumination must be intrinsically safe and explosion-proof.

I.3.3.2 Entry and Exit. Entry and exit time can be of major significance if the physical limitations of the entryway hinder the rescue of an injured person. The degree of significance is directly related to the potential hazard of the confined space. The extent of precautions taken and the standby equipment needed to maintain a safe work area are determined by the means of access and rescue. The following should be considered: type of confined space to be entered; access to the entrance; number and size of openings; barriers within the space; maximum occupancy; and time required for exiting in the event of fire or vapor incursion, or to rescue injured workers.

I.4 GENERAL WORK PRACTICES

Before entry into a confined space is allowed, the HSO will ensure that procedures necessary to ensure safe permit entry are, identified, developed and implemented. These procedures may include purging and ventilation, and isolation (lock-out/tag-out).

I.4.1 Purging and Ventilation

For entering and working in a confined space, environmental control is accomplished by purging and ventilation. Purging is the initial step in adjusting the atmosphere in a confined space to acceptable standards (i.e., Permissible Exposure Limits [PELs], Threshold Limit Values [TLVs], and LELs). This is accomplished either by displacing the atmosphere in the confined space with fluid or vapor (i.e., inert gas, water, steam, and/or cleaning solution) or by forced-air ventilation.

The method used to purge or ventilate the confined space will be determined by the potential hazards that arise due to the product stored or produced, the suspected contaminants, the work to be performed, and the design of the confined space. When ventilating and/or purging operations are to be performed, the blower controls must be at a safe distance from the confined space. When a ventilation system is operational, air flow measurements (as well as atmosphere testing) must be made before each entry to ensure that a safe environmental level is maintained. Initial testing of the atmosphere should be performed from outside the confined space before ventilation begins to determine precautions necessary for purging and ventilating. Testing of more remote regions within the confined space may be performed once the immediate area within the confined space has been made safe. Exhaust systems should be designed to protect workers in the surrounding area from exposure to contaminated air. If flammable concentrations are greater or equal to 10 percent of the LEL, all electrical equipment must be intrinsically safe and explosion-proof. Continuous ventilation is required by OSHA where ever feasible. The atmosphere must be tested until acceptable levels of oxygen and contaminants are continuously maintained for three tests at 5-minute intervals. Care must be taken to prevent recirculation of contaminated air and interaction of airborne contaminants.

Continuous general ventilation should be maintained where toxic atmospheres may develop due to the nature of the confined space or the activities being performed, as in the case of desorption from walls or evaporation of residual chemicals. General ventilation is an effective procedure for distributing contaminants from a local generation point throughout the work space to obtain maximum dilution. However, special precautions must be taken if the ventilating system partially blocks the exit opening, including methods for providing respirable air to each worker for the time necessary to exit and for maintaining communications.

I.4.2 Isolation/Lock-out/Tagging

Isolation procedures must be specific for each type of confined space. Safety equipment required during this procedure will be designated by the HSO and will depend on potential hazards involved. A Class A or B confined space must be completely isolated from all other systems by physical disconnection, double-block and bleed, or blanking off all lines. In continuous systems, where complete isolation is not possible (e.g., sewers or utility tunnels), specific written safety procedures must be used. Shutoff valves, serving the confined space, must be locked in the closed position and tagged for identification. In addition to blanking, pumps and compressors serving the lines entering the confined space must be locked out to prevent accidental activation. If a drain line is located within the confined space, provision must be made, when necessary, to tag it and leave it open; this will be recorded in the HASP.

Electrical isolation of the confined space to prevent accidental activation of moving parts that would be hazardous to workers is achieved by locking circuit breakers and/or disconnects in the open (off) position with a key-type padlock. The only key to the padlock is to remain with the person working inside the confined space. If more than one person is inside the confined space, each person must place his own lock on the circuit breaker. In addition to the lockout system, there must be an accompanying tag that identifies the operation and prohibits use.

Mechanical isolation of moving parts can be achieved by disconnecting linkages or removing drive belts or chains. Equipment with moving mechanical parts must also be blocked to prevent accidental rotation.

I.5 EQUIPMENT

The HSO will ensure that prior to entering a confined space, all required equipment is present on site, in good working order, and that all associates are knowledgeable in their use. The HASP and entry Permit will include a list of necessary protective equipment to be used in the confined space, as determined by the HSO. Items to consider include head, eye, face, and foot protection against traumatic injury, respiratory, hand, and body protection for chemical hazards injuries, as well as ventilating, monitoring and rescue equipment.

Equipment that may be required on sites includes the following:

- Testing and monitoring equipment
- Ventilating equipment
- Communication equipment
- Personal protective equipment
- Lighting equipment
- Barriers and shields
- Ladders or other means of ingress or egress
- Rescue and emergency equipment
- Other

Standard items required at all sites are identified on the entry permit.

I.5.1 Eye and Face Protection

If eye-irritating chemicals, vapors, or dusts are present, safety goggles are required, unless a full-face respirator is used. If both the face and eyes are exposed to a hazard (e.g., during scraping scale), a full-face shield and goggles must be used. For those who wear corrective glasses, prescription safety glasses or goggles can be acquired through ABB Environmental Services, Inc. (ABB-ES). As a general safety precaution, eye protection meeting the requirements and specifications of American National Standards Institute (ANSI) Standard Z89.1-1981 Class B should be worn at all times while in the confined space.

I.5.2 Head Protection

Hard hats must be worn if working directly under the manhole or entryway, if there is any danger of items falling on the worker's head, or as an adjunct to face protection. All hard hats must meet the requirements and specifications of ANSI Standard 289.1-1968.

I.5.3 Foot Protection

Steel-toe, steel-shank, chemical-resistant boots (or boot covers) must be worn when entering a confined space if there is a danger of falling objects, stepping on a sharp object or nail, and/or chemical contaminants. All safety-toe footwear must meet the requirements and specifications of ANSI Standard 241.1-1967.

I.5.4 Body Protection

The level of dermal protection to be worn by all personnel entering the confined space will be determined by the HSO, based on all data available. In choosing the level of protection, the HSO must consider the chemical hazard present, as well as the potential for heat and cold stress.

I.5.5 Hearing Protection

A hearing conservation program must be implemented if sound pressure levels equal or exceed 85 dBA (decibels on the A scale), based on an 8-hour, time-weighted average (TWA). Hearing protection is mandatory for noise levels above 90 dBA, and optional between 85 and 90 dBA. If noisy conditions are expected within the confined space, the HSO should notify the Health and Safety Manager (HSM) or the Health and Safety Supervisor (HSS) and make arrangements to have ear plugs at the site.

I.5.6 Respiratory Protection

The HSO will determine the level of respiratory protection, based on conditions and test results of the confined space and the work activity to be performed. (See Table I-2 and Attachment 1 for selection guidelines.)

I.5.7 Hand Protection

Gloves of impervious rubber or similar material are to be worn to protect against toxic or irritating materials. If rough surfaces or sharp edges are expected, canvas or metal mesh can be worn over the rubber gloves. Where isolation of the electrical system is impossible, and current flow of more than 5 milliamperes through the body could potentially occur due to contact with energized electrical equipment, insulating gloves should be worn. These gloves must meet the requirements and specifications of ANSI Standard J6.6-1967.

I.5.8 Safety Belt/Harness

Non-entry rescue (e.g., retrieval systems) must be used whenever an authorized Entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant. Each Entrant shall use a chest or full body harness with a retrieval line attached at the center of the Entrants back near shoulder level or above the Entrants head. Wristlets may be used in lieu of the chest or full body harness if the ABB-ES can demonstrate that the use of a chest or full body harness is infeasible or creates a greater hazard and that the use of wristlets is the safest and most effective alternative (e.g., opening is less than 18 inches in diameter). The other end of the retrieval line must be attached to a mechanical device or fixed point outside the permit space in such a manner that rescue can begin as soon as the rescuer becomes aware that rescue is necessary. A mechanical device must be available to retrieve personnel from vertical type spaces of greater than 5 feet deep.

I.5.9 Other

When employees enter a confined space, a barricade must be erected if inadvertent entry poses a problem. The barricade must have a mechanism to prevent closure of the escapeway, signs warning of the danger present, a physical barrier (i.e., fence) to keep the area clear, and an adequate platform (a minimum size of 3 by 3 feet) for entry or exit. Added features such as a tripod with either block and tackle or a mechanical pulley mechanism should be used in situations where quick removal of a worker may be required. Communications equipment (i.e., intercoms or radio systems) should be considered when the entry plan is formulated.

I.5.10 Equipment and Tools

Equipment and tools to be used in a confined space must be carefully inspected, and must meet the following requirements:

- Hand tools must be kept clean and in good repair.
- Portable electric tools, equipment, and lighting must be equipped with a ground fault circuit interrupter. All grounds must be checked before electrical equipment is used in a confined space.
- All electrical cords, tools, and equipment must be heavy duty, with heavy duty insulation, and inspected for visually detectable defects before use in a confined space. For use in a flammable atmosphere, their design must be explosion-proof and intrinsically safe.
- Air-driven power tools must be used when flammable liquids are present. The use of air-driven power tools will only reduce the risk of explosion, not eliminate it. Explosions can result from tools overheating (e.g., drilling), sparks produced by striking (e.g., percussion), grinding, or discharge of accumulated electrostatic charges developed from the flow of compressed air.
- Lighting used in Class A and Class B confined spaces must be explosion-proof and intrinsically safe and, where necessary, equipped with guards. Only equipment listed by the Underwriters Laboratories for use in Division 1, atmospheres of the appropriate class and group, or approved by U.S. Bureau of Mines, Mining Enforcement and Safety Administration, Mine Safety and Health Administration, or the U.S. Coast Guard should be used. Lighting should not be hung by electrical cords, unless specifically designed for that purpose. The illumination of the work area must be sufficient to provide for safe working conditions. Under no circumstances will matches or open flames be used in a confined space for illumination.

- Cylinders of compressed gas must never be taken into a confined space, and should be turned off at the cylinder valve when not in use. Exempt from this rule are cylinders that are part of self-contained breathing apparatus (SCBA) or resuscitation equipment.

- Ladders should be adequately secured, or of a permanent type that provides the same degree of safety.

- Scaffolding and staging must be properly designed to carry maximum expected load (safety factor of four), and be equipped with traction-type planking.

- Only hose lines and components specially designed for the compressed gas and working pressure should be used, and such systems must have a pressure relief valve outside the confined space.

I.6 Testing and Monitoring

Prior to entry into a confined space, workers must know its potential hazards. Deaths *have* occurred because a presumably safe space was not tested before initial entry. The OSHA Permit-Required Confined Space standard requires the following sequence of testing, in the order given, prior to entry into confined spaces:

1. Oxygen Content
2. Flammability
3. Toxic Chemicals

In addition to testing for chemical hazards, harmful physical agents (e.g., explosive dusts, noise, etc.) should also be conducted.

Specific instruments are required to test the atmosphere for these conditions. For example, combustible gas indicators are designed to measure the concentration of flammable gases, and will not measure or indicate the presence of carbon monoxide (CO) at toxic levels; conversely, a CO detector is designed to measure CO only. Combustible gas indicators respond differently to different flammable hydrocarbons; therefore, entry into confined spaces with flammable gas concentrations above 20 percent of the Lower Explosive Limit (LEL) should be avoided. The flammability measurement may be erroneous if the oxygen level is less than or greater than normal atmospheric concentrations. Therefore, it is required that the oxygen level be determined prior to flammability testing to make any necessary corrections in the flammability measurement.

The oxygen-deficiency measuring instrument is designed to measure the volume of oxygen present, usually scaled with a range of zero to 25 percent. If the oxygen level in a confined space atmosphere is less than 19.5 or greater than 23.5 percent, special precautions must be taken. In accordance with Occupational Safety and Health Administration (OSHA) Standard 29 CFR Part 1910 and other references, a minimum oxygen level of 19.5 percent has been adopted for worker safety. (This assumes that the 1.4 percent displaced oxygen was replaced with a nonhazardous substance.) The upper oxygen limit has been set at 23.5 percent because an increase above this level will greatly increase the rate of combustion of flammable materials.

Continuous and/or frequent monitoring becomes necessary in cases where the work being performed within the confined space has the potential of generating toxic agents. Data collected for the National Institute for Occupational Safety and Health (NIOSH) show that in 28 of 80 accident events, the toxic gas or oxygen deficiency was not in the confined space at the time of entry, but was either generated by the work occurring in the space, or by gas being unexpectedly admitted into the confined space after the worker had entered. In these cases, only continuous and/or frequent monitoring would be a possible countermeasure.

I.7 Entry Permit

Before entry into a confined space is authorized, the HSO must document the completion of all required safety measures required by the OSHA Permit-Required Confined Space Standard. Documentation of these measures is done on the Confined Space Entry Permit (see Attachment 1, 2, and 3). Entry into any confined space is by permit only unless first cleared by the HSM. The entry permit is an authorization and approval, in writing, that specifies the personnel permitted to enter the space and the location and type of work to be done. It certifies that all known hazards have been evaluated and necessary protective measures have been taken to ensure the safety of each worker. The entry permit will identify the permit space to be entered, the purpose of the entry, the date and authorized duration of the entry, the authorized entrants, the authorized attendants, the name and signature of the

HSO, the hazards, measures used to isolate or eliminate the hazards, acceptable entry conditions, results of initial and periodic air monitoring, rescue and emergency procedures, communication procedures, equipment, as well as any other pertinent information or permits (e.g. for hot work) required.

At the site, the HSO acts as the Entry Supervisor and is responsible for the completion of the Confined Space Entry Permit and/or the Manhole/Sewer Entry Permit, ensuring that atmospheric testing has been conducted and all safety precautions have been addressed. The Permit will be posted at or near the entry portal so that all associates can confirm that pre-entry preparations have been completed. The entry permit applies only to the task or job identified and entry into the confined space cannot exceed the time required to complete the assigned task or job.

The HSO will terminate entry and cancel the entry permit when entry operations covered by the permit have been completed or a condition not allowed by the permit arises in or near the confined space. If problems are encountered during the entry operation, the HSO shall note it on the permit.

THE COMPLETED PERMIT MUST BE SENT TO THE HSM AS ABB-ES MUST RETAIN AND REVIEW EACH CANCELLED PERMIT ANNUALLY.

I.8 TRAINING/HEALTH MONITORING

ABB-ES personnel required to work in confined spaces, or in support of those working (if their duties include emergency rescue) in confined spaces, must be in the Health Monitoring Program and have received the 40-hours of initial hazardous waste site training, initial Confined Space Entry training, and site specific training. In addition, associates who act as Rescue personnel must maintain current certification in first aid and CPR and be trained in and have practiced rescue procedures immediately prior to entry.

As ABB-ES workers encounter a variety of confined spaces at a various locations, site specific training plays an important role in informing associates of the hazards associated with the entry. Site specific training shall be conducted prior to each entry, whenever there is a change in operations which an associate has not previously been trained, when there is a reason to believe that there are deviations from the permit space entry procedures, or inadequacies in the associate's knowledge or use of the procedures.

Training will include, but limited to, a review of the contents of the HASP and permit, verification of associate knowledge and/or training on the use all equipment to be used, emergency procedures, site specific hazards and the duties of their assigned role.

I.9 ROLES AND RESPONSIBILITIES

I.9.1 Duties of Authorized Entrants

The authorized entrants are the workers who actually enter the confined space and are therefore at the greatest risk. Because of this added degree of risk, these workers must be knowledgeable of the hazards they may be faced with during entry, including the mode, signs or symptoms, and consequences of the exposure and have the knowledge and skills necessary to recognize a prohibited condition or dangerous situation. The Entrants must be made aware of and know the use of all the equipment they are required to use while in the confined space.

Communication is very important while workers are in a confined space. Entrants and Attendant must be in constant communication with each other to:

- Enable the Attendant to monitor the Entrants status

- To allow the Entrant to alert the Attendant whenever the Entrant recognizes any warning sign or symptom of exposure to a dangerous situation, or when the Entrant detects a prohibited condition.

- To have the Entrant exit from the permit space as soon as possible whenever an order to evacuate is given by the Attendant or the HSO, when the Entrant recognizes any warning sign or symptom of exposure to a dangerous situation, when the Entrant detects a prohibited condition, or when an evacuation alarm is detected.

I.9.2 Duties of Attendants

The Attendant is responsible for ensuring the safety of the Entrants into a confined space and therefore must not perform any other duties that might interfere with the Attendants primary duty of monitoring and protecting the Entrants. The Attendant must be aware of the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure. The Attendants must be aware of the possible behavioral effects of the hazard exposure and continuously maintain an accurate count and identification of the authorized entrants in the space. The Attendant remains outside the permit space at all times during entry operations until he/she is relieved by another attendant. The Attendant must be in constant communication with the Entrants to monitor their status and to alert entrants of the need to evacuate the space. The Attendant monitors activities inside and outside the space to determine if it is safe to remain in the space and orders the Entrants to evacuate immediately under any of the following conditions:

- The Attendant detects a prohibited condition
- The Attendant detects the behavioral effects of a hazard exposure
- The Attendant detects a situation outside the space that could endanger the Entrants.
- The Attendant cannot effectively and safety perform all his/her duties.

The Attendant is responsible for summoning rescue and other emergency services as soon as the Attendant determines that the Entrants may need assistance and warns unauthorized persons that they must stay away or exit the space immediately should they approach or enter the confined space while entry is underway. Should unauthorized persons approach or enter the confined space, the Attendant must inform the HSO immediately.

The attendant is allowed to perform non-entry rescue only unless they meet the requirements to be on the Rescue Team and they are first relieved by another attendant.

I.9.3 Duties of Entry Supervisors (HSO)

The Entry Supervisor (HSO) has overall responsibility for the entry into the confined space. They are required to be knowledgeable of the hazards associated with the entry, including information on the mode, signs or symptoms, and consequences of exposure. The HSO is responsible for verifying, by checking, that the appropriate entries have been made on the permit, that all tests have been conducted, and that all procedures and equipment specified by the permit or in the HASP are in place before endorsing the permit and allowing entry. In addition, the HSO is responsible for terminating the entry and cancelling the permit whenever entry operations covered by the permit have been completed or if conditions not allowed under the entry permit arises in or near the space.

The HSO is required to ensure that all affected workers are properly trained and receive site specific training. The HSO is required to verify that the rescue services are available and the means for summoning them are operable. If ABB-ES rescue team is used, the HSO is responsible for ensuring that all Rescue team members have practiced rescues from the actual or a representative space prior to (within the last 12 months) authorizing entry into the confined space.

He/she is responsible for removing unauthorized individuals who enter or attempt to enter the confined space during entry operations. If the responsibility for a confined space is transferred or at predetermined intervals based on the hazards and operations performed with in the space, he/she determines that entry operations remain consistent with the terms of the permit and that acceptable entry conditions are maintained.

I.9.4 Duties of Rescue and Emergency Services

Non-entry rescue (e.g., retrieval systems) must be used whenever an authorized Entrant enters a permit space, unless the retrieval equipment would increase the overall risk of entry or would not contribute to the rescue of the entrant.

The HSO must identify and verify that rescue and emergency services are available prior to allowing entry into a confined space. Rescue and emergency services personnel can be ABB-ES associates only if the following conditions are met.

Each member of the rescue team has received the following training:

- Proper use of personal protective equipment
- Proper use of rescue equipment necessary for making rescues from permit spaces
- Assigned Rescue duties
- Duties of the authorized Entrants.
- First aid
- CPR

The Rescue team must practice making confined space rescues at least once every 12 months from the actual or a representative confined space. A representative space is one in which the opening size, configuration, and accessibility is similar to the actual confined space. As it will be difficult to anticipate the types of spaces that ABB-ES associates encounter, the practice rescue will more than likely have to take place immediately prior to entry using the actual confined space. When simulating rescue operations, workers must practice removing dummies, manikins, or actual persons from the confined space (or a representative space).

If an outside service is to be used for rescue, the HSO must inform the rescue service of the hazards involved with entry into the space, and provide access to all the confined space(s) so that they can develop appropriate rescue plans and practice rescue operations.

I.10 RESCUE PROCEDURES

Rescue procedures to be used are site specific and will be developed as part of the HASP.

I.11 HOST EMPLOYER/CONTRACTOR/SUBCONTRACTOR

When confined space entry procedures are done in conjunction with another company (host employer/contractor/subcontractor), the entry will be coordinated to ensure that is done is a safe manner for all concerned. If the host employer or Contractor has existing confined space entry procedures, ABB-ES will attempt to obtain and review these procedures as well as all available information regarding the space and the hazards associated with it. If the host employer's/contractor's procedures meet ABB-ES minimum safety procedures, those precautions and procedures will be used. If ABB-ES feels that more stringent entry procedures are warranted, they will notify the host employer of the methods they will use when entering the confined space.

If ABB-ES is the General Contractor at the site, they will notify the subcontractor of the existence of permit-required confined spaces and that entry is allowed only through compliance with an Confined Space Entry Program. ABB-ES will notify the subcontractor of the hazards, precautions, and procedures ABB-ES has implemented for working in or near the space.

All entries will be coordinated with the host employer, contractor, or subcontractor personnel as required. ABB-ES will debrief the subcontractor or inform the host employer/contractor at the conclusion of the entry operations of any hazards confronted or created in the confined space.

I.12 REVIEW OF PERMIT-REQUIRED CONFINED SPACE PROGRAM

The HSM will review the Permit-Required Confined Spaces program on an annual basis or whenever there is reason to believe that measures taken under the program may not protect ABB-ES associates. The HSM will review the Program using the completed permits as well as all other available information as a guide. Based on the findings, the HSM will revise the Program, as appropriate to correct deficiencies to ensure that associates are protected from permit space hazards. No associate will be allowed to enter a confined space until all deficiencies are corrected.

I.13 GENERAL ENTRY PROCEDURES

This subsection describes general entry procedures for confined spaces. The actual procedures used on a site may vary, depending on site conditions and the hazards associated with the confined space.

I.13.1 Team Size

A minimum of two workers are required for each confined space activity, one Entrant and One Attendant/Entry Supervisor (HSO). This is for a relatively non-hazardous space where a non-entry retrieval system is being used. Arrangements for a rescue team must still be done, however, they do not have to present during the entry. Additional personnel will be needed for larger, hazardous, more complex entries, especially where there is a possibility that a rescue team may need to enter the space to rescue the Entrant. In these circumstances, a minimum of four workers are required, one Entrant, one Attendant, one HSO, and one Rescue.

These are the minimum numbers required, in most cases. Additional crew members may be needed if entering a Class A or Class B confined spaces, or specialty tasks must be completed. Additional crew could include additional Entrants, decontamination personnel, etc.

I.13.2 General Entry Procedures

The following steps must be taken when entering a confined space:

(1) Check and calibrate all pieces of equipment to ensure they are in good working order. DO NOT ENTER A CONFINED SPACE WITH DEFECTIVE EQUIPMENT!

(2) Conduct a background check to identify all potential hazards that may be encountered in the confined space. Determine if there is a potential for fire/explosion hazards, as well as a toxic or oxygen-deficient atmosphere.

(3) Define and demarcate the exclusion zone with flagging or some other method. Ensure that the entrance into the confined space remains locked, blocked, or otherwise protected until workers are ready to enter the space. If the entrance cannot be protected from unauthorized entry, place a sign one or near the entry stating **DANGER - PERMIT-REQUIRED CONFINED SPACE, DO NOT ENTER.**

(3) Before entry, test the atmosphere inside the confined space. An attempt should be made to test the atmosphere without opening the entryway (i.e., through a vent line or a small opening). If the entryway must be opened to

test and only low levels are expected in the confined space, crack open the entryway, test the breathing zone first, and then test the confined space. If potentially high levels are expected in the breathing zone, respiratory protection should be worn while opening the entryway cover.

(4) If an oxygen deficient, explosive, or toxic atmosphere is detected, purge or ventilate the confined space before entry. Retest the atmosphere three times at 5-minute intervals. A person can enter the confined space without respiratory protection only if all three test results are below the PEL/TLV, 10 percent of the LEL, and above 19.5 percent oxygen (all three conditions *must* be met). (NOTE: Any downward deflection of the readings on the oxygen meter from background [i.e., 20.9 percent] should be viewed as a potential for an IDLH atmosphere. Unless contaminants are known to be nontoxic, do not enter the confined space without respiratory protection if the oxygen level is below background.

(5) Blank, block, or otherwise isolate, lock-out, and tag all chemical, physical, and/or electrical hazards, wherever possible.

(6) If Entrants are using an air-purifying respirator or if an IDLH and/or explosive atmosphere exists, air monitoring must be on a continuous basis. If respiratory protection is not used and there is potential for atmospheric conditions to change due to work practices or conditions, air monitoring should be done continuously or periodically as site conditions warrant. In all these cases, a 5-minute escape pack must be used.

(7) Record all results of the tests for hazardous conditions, including the location, time, date, weather (if applicable), and readings on the photo-ionization detector (PID), combustible gas meter, oxygen-deficiency meter, Draeger tubes, and any other equipment used on the Confined Space Entry Permit.

(8) Wear appropriate clothing for site conditions, as determined by the HSO.

(9) Wear a safety belt or harness with lifeline when entering a confined space unless their use is not feasible or is a safety hazard. If the diameter of the entryway is less than 18 inches, the wrist-type harness must be use, and special provisions made if a supplied-air respirator is necessary.

(10) The HSO must check to ensure that the Confined Space Entry Permit is completed and all associates are adequately trained before authorizing entry.

(11) One person (Attendant) must remain at the entryway at all times and must maintain continuous contact with the person entering the confined space. Contact can be maintained by line of sight, listening for sounds, the safety line, and/or radio. The Attendant must not enter the confined space unless the non-entry retrieval is inoperable or infeasible, they are a trained rescuer, another trained person is available to act as an Attendant, and he/she is equipped with adequate respiratory and dermal protection. (In most cases, respiratory protection would be an airline respirator or SCBA.)

(12) Do not smoke when working in or near confined spaces, and do not take flash-lit photographs when explosive gases are known or suspected to be present.

(13) Do not rely on permanent ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect permanent ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use a portable ladder of adequate height to reach 3 feet above opening, or a rope ladder, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off, if possible; otherwise, it should be held in place by the standby person.

(14) Do not work without adequate lighting. Use only explosion-proof lights or hand lamps.

(15) The entry person must not remain in the confined space if he/she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Many gases that cause the most problems are odorless, tasteless, and invisible.

(16) THE HSO MUST CANCEL THE PERMIT, NOTE AND PROBLEMS ENCOUNTERED AND SEND COMPLETED FORM TO THE HSM IN PORTLAND MAINE.

I.13.3 Manhole/Sewer Entry

When preparing to enter a manhole/sewer, the following safety measures must be taken.

(1) Check all pieces of equipment to ensure they are in good working order. DO NOT ENTER THE MANHOLE WITH DEFECTIVE EQUIPMENT!

(2) Park the vehicle near the manhole (DO NOT leave the vehicle running). If the manhole is in the street, it is best to park so as to detour oncoming traffic around the manhole. The vehicle's emergency flashers and portable yellow warning beacon must be ON. The vehicle serves as protection from oncoming traffic, can be used to store emergency equipment (e.g., SCBA and first-aid kit), and can be used in extreme emergency to slowly pull an injured person from the confined space if a tripod with hoist attachment is unavailable or inoperable.

(3) When appropriate, erect portable barricades or cones around the manhole and in front of the vehicle to adequately divert traffic and to prevent pedestrians from falling in. Reflective vests should be worn so that workers are visible to approaching traffic.

(4) If there are openings large enough to admit sampling tubes, test for the presence of explosive and toxic gases before removing each manhole cover. Otherwise, raise one side of the cover using the cover hook or pick, prop it slightly open, and conduct the tests.

(5) If toxic or explosive gases are detected in the sewer that could be indicative of a spill, leak, or otherwise hazardous condition, report this immediately to the local fire department and/or department of public works.

(6) On the Manhole/Sewer Entry Permit, record the results of tests for hazardous conditions, including location, manhole number (if applicable), time, date, weather (if applicable), and readings on the PID, combustible gas meter, oxygen-deficiency meter, and Draeger tube. Once the Manhole/Sewer Entry Permit is completed, the HSO will verify all information before authorizing entry.

(7) Remove manhole covers with a cover hook or pick; do not improvise. Be careful of fingers and toes; the cover is usually heavy and difficult to handle. Unless the cover is extremely heavy, it is safer for only one worker to handle it.

(8) Test the atmosphere; if a toxic, flammable, or oxygen-deficient atmosphere exists, ventilate the sewer. Depending on the hazard, ventilation can be accomplished in several ways; for example: (1) remove and vent the adjoining upstream and downstream manhole covers, as soon as possible, and well in advance of entering the manhole (high hazard); and (2) vent the manhole in which entry will occur (very low hazard). If a blower is used, it is desirable to establish a flow of air in the sewer; that is, in one manhole and out another. Ensure that the air intake is well away from automobile exhaust, and combustible and/or toxic atmospheres. Appropriate traffic control measures must be taken by barricading or otherwise marking the open manholes.

(9) After ventilating, test for explosive and toxic gases and oxygen deficiency in the manhole at ground level and at the bottom; record the results. If entering the sewer itself, perform the same tests at the manholes at either end. If ventilation is necessary, monitor the atmosphere in the manhole while work progresses, or continue operation of the blower. Continuous monitoring (i.e., equipment ON during entire entry) is imperative because conditions within the sewer may change rapidly. Do not enter a manhole while there is an oxygen deficiency without a pressure-demand, air-supplied breathing apparatus. If the oxygen level is lower than 20.9 percent of background, caution must be taken because an IDLH atmosphere may exist.

(10) When entering manholes or tanks, wear hard hats, protective clothing, and appropriate respiratory protection and safety belt or harness with lifeline (when appropriate). If the manhole is less than 18 inches in diameter, a wrist-type harness must be used and special provisions made if air-supplied respirators are necessary. When working in manholes deeper than 12 feet, in the sewer itself, or where potential exists for gases to appear unexpectedly, a 5-minute emergency egress air supply is required (unless the time required to don the emergency respirator is greater than what would be needed to exit the manhole).

(11) At least one person (i.e., standby) must remain at the manhole at all times and must maintain continuous contact with the person entering the sewer. Contact can be maintained by line of sight, listening for prearranged sounds, and the safety line signals and/or radio. The standby person must not enter the manhole unless another trained person is available to act as standby and has adequate respiratory and dermal protection available. (In most cases, respiratory protection will be an airline respirator or SCBA.) The standby/rescue person should be suited up (but not yet on air) before the work crew enters the confined space.

(12) Do not smoke when working in or near manholes. Do not take flash-lit photographs when explosive gases are known or suspected to be present.

(13) Do not rely on the manhole ladders because they are often in poor condition. If they must be used, be sure of footing. Inspect manhole ladders for deterioration before entering and while descending. Try each step with one foot, while standing on the step above. When in doubt, use a portable or rope ladder of adequate height to reach 3 feet above the manhole opening, or lower the entry person using the tripod. If a portable ladder is used, it should be tied off if possible; otherwise, it should be held in place by the standby person.

(14) Do not work without adequate lighting. Use only explosion-proof lights or hand lamps in the manhole or sewer.

(15) The entry person must not remain in the manhole or sewer if he/she becomes even slightly drowsy, faint, dizzy, or otherwise uncomfortable. Remember that CO, carbon dioxide, methane, and hydrogen sulfide, which cause the most trouble, are odorless (e.g., hydrogen sulfide has a distinct odor only during initial exposure), tasteless, and invisible gases.

(16) Once the permitted work is completed, the HSO will cancel the permit, note any problems, and send it to the HSM in Portland Maine.

I.13.4 Alternate Procedures

ABB-ES may use the alternate procedures described below for entering a confined space when they can demonstrate and document, through monitoring and inspection data, that the only hazards associated with the space are atmospheric and that continuous forced air ventilation alone is sufficient to maintain the space safe for entry. If workers must first enter the space to obtain the data required to demonstrate that alternate procedures can be used, the entry shall be done through the use of a permit in compliance with the all sections of the Permit-Required Confined Spaces standard.

By definition, if a space requires Level C or B PPE during entry, or if the work conducted within the space can create a hazardous situation, then the alternate procedures cannot not be used. (Note: The use of respiratory protection may only be used when first opening the entrance cover if an exposure to a hazardous atmosphere is possible. Respiratory protection should be discontinued once forced air ventilation has eliminated the atmospheric hazards.)

(1) Review all available information to ensure alternate procedures can be used for entry into the space. If any hazards exist or can be generated, aside from atmospheric, (e.g., engulfment, entrapment, electrical, mechanical, any other serious safety or health hazard), these procedures cannot be used. (See Section G.13.0 - General Entry Procedures).

(2) All workers must have certificates stating that they have attended a Confined Space Entry training course.

(3) Inspect and calibrate all pieces of equipment to ensure they are in good working condition. DO NOT ENTER A CONFINED SPACE WITH DEFECTIVE EQUIPMENT!

(4) Evaluate the conditions around the entrance cover to the confined space. Any existing conditions that make it unsafe to remove the cover must be eliminated. These conditions include both chemical and physical hazards.

(5) Once the entrance cover is removed, the entryway shall be immediately guarded by a railing, temporary cover, danger tape, or some other temporary barrier that will prevent an accidental fall through the opening and that will protect each employee working in the space from foreign objects entering the space.

(6) Monitor the breathing zone and then the entryway in the following order: 1) oxygen; 2) LEL; and 3) toxic chemicals. When monitoring for toxic chemicals, use one or any combination of the following meters as appropriate: PID, FID, Hydrogen Sulfide Meter, and/or Draeger tubes. Other meters may also be used as appropriate. NOTE: If there is a potential for high concentrations (i.e., above the PEL/TLV) then respiratory protection during this stage is mandatory.

(7) Monitor the internal atmosphere (top, middle, and bottom) for the following in the order given: 1) oxygen; 2) LEL, 3) toxic chemicals. If the largest reading is:

1. $\leq$ 19.5 % Oxygen
2. $\geq$ 10 % LEL
3. $\geq$ ½ PEL/TLV

than the space must be ventilated using forced air ventilation. If all the readings (top, middle, and bottom) within the space are within acceptable ranges for entry, than entry can be conducted without ventilation.

(8) If forced air ventilation is required, it must be directed so as to ventilate the immediate area(s) where associates are working and will continue until all associates have left the confined space.

(9) The air supply for the forced air ventilation must be from a clean source, and not located near running vehicles, motors, or some other sources of contamination.

(10) The atmosphere within the space must be periodically tested, as necessary, to ensure that the continuous forced air ventilation is preventing the accumulation of a hazardous atmosphere. In addition, as the exhaust for the contaminated air will more than likely be through the entryway, the breathing zone of any workers standing outside the space should also be periodically monitored to ensure the levels are within acceptable ranges.

(11) If a hazardous atmosphere is detected during entry, each associate must leave the space immediately and the space evaluated to determine how the hazardous atmosphere developed. Measures must then be taken to prevent

a reoccurrence of the situation leading to the development of the hazardous atmosphere before allowing any subsequent entry. If a reoccurrence cannot be prevented, entry must then be conducted using a permit in compliance with the entire Permit-Required Confined Spaces standard.

(12) The HSO must verify that the space is safe for entry and that all the required measures have been take. Once verification has taken place, the HSO will ensure all sections of the Confined Space Entry - Alternate Procedures form is completed and has his/her signature certifying the space is safe for entry.

(13) All entrants are required to review and sign the Confined Space Entry - Alternate Procedures form.

The following sections of the Permit-Required Confined Spaces standard are <u>not</u> required when using the Alternate Procedures:

- A written Permit-Required Confined Space Program.
- The establishment of a permit system.
- The use of an Entry Permit.
- Specific training and responsibilities for an Entrant.
- Specific training and responsibilities for an Attendant.
- Specific training and responsibilities foe an Entry Supervisor.
- Specific training and responsibilities for Rescue and Emergency personnel.

CONFINED SPACE ENTRY PERMIT
29 CFR 1910.146

S Name: ____ Site Location: ____
P se of Entry: ____
Contaminants: ____
Type of Confined Space: ____
Date and Time of Entry: ____ Date and Time Permit Expires ____

POTENTIAL HAZARDS: (Check all that apply)

[ ]	Flammable	[ ]	Moving Parts	[ ]	Radioactive	[ ]	Entrapment
[ ]	O_2 Deficiency	[ ]	Valves & Pipes	[ ]	Noise	[ ]	Engulfment
[ ]	Toxic	[ ]	Electrical	[ ]	Heat	[ ]	Other ____

EQUIPMENT REQUIRED: (Check all that apply)

X	LEL/O_2 Meter	X	Safety Harness	[ ]	Level A	X	Standby SCBA
[ ]	PID	X	Lifeline	[ ]	Level B	[ ]	Ladder
[ ]	FID	[ ]	Hoist	[ ]	Level C	[ ]	Barrier and shield
[ ]	Draeger Tubes	[ ]	Ventilation	[ ]	Mod. Level D	[ ]	Radio
[ ]	Hydrogen Sulfide	[ ]	Lighting	[ ]	Level D	[ ]	Cellular Telephone
[ ]	Other: ____						

ACCEPTABLE ATMOSPHERIC LEVELS FOR ENTRY:

. .5% = Oxygen
<10%* = LEL
<10% = Hydrogen Sulfide Meter

____ = PID/FID
____ = Draeger Tube ____
____ = Other ____

*May use <20% LEL as long as precautions are taken (e.g., non-sparking tools, intrinsically safe equipment)

ATMOSPHERE TESTING RESULTS:
Record time and results of readings at Entryway (prior to opening door or cover), Initial atmosphere (greatest of top, middle or bottom of space), when atmosphere has Stabilized after ventilation (greatest of top, middle, or bottom of space), and periodically thereafter in the worker's Breathing Zone.

	Entryway	Initial*	Stabilized	Breathing Zone	Breathing Zone	Breathing Zone	Breathing Zone
Time							
% Oxygen							
% LEL							
H_2S Meter (ppm)							
PID/FID (ppm)							
Draeger Tube (ppm) Tube:							
Other (list)							

*If initial readings are acceptable, workers can enter space in Level D or Modified Level D withhout ventilation.

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CONFINED SPACE ENTRY PERMIT
29 CFR 1910.146

Yes	No	N/A	
			All identified atmospheric and physical hazards are controlled.
			All hazards introduced by the work performed are addressed (e.g., welding fumes).
			Air intake of the ventilation system is located in an area free of contaminants.
			Valves, pipes, and mechanical and electrical equipment has been locked–out, blocked chocked, disengaged or otherwise disconnected where necessary.
			All required equipment and rescue equipment is present and in good working condition.
			Non–sparking tools and intrinsically safe equipment and lighting are used if required.
			All monitoring instruments have been properly calibrated.
			All workers have initial confined space entry training certification.
			All workers receive site specific confined space entry training.
			Rescue team members practiced rescue operations in space or similar space. Practice Date:____________________
			All rescue team members certified in first aid and CPR.
			Entry coordinated with subcontractors.

N/A – Not Applicable

DESCRIPTION OF RESCUE PROCEDURES:

____

____

____

PROBLEMS ENCOUNTERED: Was rescue required?____

____

____

SIGNATURES:

I have reviewed the work authorized by this permit and the information contained here–in. Written instructions and safety procedures have been received and understood. I understand that this permit is not valid and the permit cannot be approved and entry conducted if any of the above squares are marked "NO" or if required sections are incomplete.

Entrants: ____________________ ____________________

Attendants: ____________________ ____________________

Rescue Team: ____________________ ____________________

Other: ____________________ ____________________

Permit prepared by: ____________________________

Entry Authorized by (HSO): (Print)____________________ (Signature)____________________

PERMIT CANCELLATION:

Reason: ____

HSO Signature: ________________________

☐ Copy of form sent to Health and Safety Manager, Portland, ME. (mandatory)

MANHOLE/SEWER ENTRY PERMIT
29 CFR 1910.146

Si' 'ame:______________ Site Location:______________

Pι .e of Entry:______________ Date and Time of Entry:______________

ACCEPTABLE ATMOSPHERIC LEVELS FOR ENTRY:

>19.5% = Oxygen
<10%* = LEL
<10% = Hydrogen Sulfide Meter

_______ = PID/FID
_______ = Draeger Tube ______________
_______ = Other ______________

*May use <20% LEL as long as precautions are taken (e.g., non-sparking tools, intrinsically safe equipment)

EQUIPMENT REQUIRED: (Check all that apply)

X	LEL/O_2 Meter	X	Safety Harness		Level A	X	Stand by SCBA
	PID	X	Lifeline		Level B		Ladder
	FID	X	Hoist		Level C		Barrier and shield
	Draeger Tubes		Ventilation		Mod. Level D		Radio
	Hydrogen Sulfide		Lighting		Level D		Cellular Telephone
	Other:______________						

ATMOSPHERE TESTING RESULTS:

R d time and results of readings at Entryway (prior to opening door or cover), Initial atmosphere (greatest of top, middle or bottom of space), when atmosphere Stabilizes after ventilation (greatest of top, middle, and space), and periodically thereafter in the workers Breathing Zone.

	Entryway	Initial*	Stabilized	Breathing Zone	Breathing Zone	Breathing Zone	Breathing Zone
Time							
% Oxygen							
% LEL							
H_2S Meter (ppm)							
PID/FID (ppm)							
Draeger Tube (ppm)							
Other (list)							

*If initial readings are acceptable, workers can enter space in Level D or Modified Level D withhout ventilation.

DESCRIPTION OF RESCUE PROCEDURES:

Full chest of body harness with retrieval line connected in the center of back at shoulder level or above entrants head. Retrieval line will be connected to tripod with hoisting device. Non-entry retrieval will be conducted. If entry for rescue is required, workers will don Level B PPE.

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MANHOLE/SEWER ENTRY PERMIT
29 CFR 1910.146

Yes	No	N/A	
			All identified atmospheric and physical hazards are controlled.
			All hazards introduced by the work performed are addressed (e.g., welding fumes).
			Air intake of the ventilation system is located in an area free of contaminants.
			All required equipment and rescue equipment is present and in good working condition.
			Non-sparking tools and intrinsically safe equipment and lighting are used if required.
			All monitoring instruments have been properly calibrated.
			All workers have initial confined space entry training certification.
			All workers received site specific confined space entry training.
			Rescue team members practiced rescue operations in space or similar space. Practice Date:____________________
			All rescue team members certified in first aid and CPR.
			Entry coordinated with subcontractors.

PROBLEMS ENCOUNTERED:

____

____

____

____

Was rescue required?____

SIGNATURES:
I have reviewed the work authorized by this permit and the information contained here-in. Written instructions and safety procedures have been received and understood. I understand that this permit is not valid and the permit cannot be approved and entry conducted if any of the above squares are marked "NO" or if required sections are incomplete.

Entrants: ____________________ ____________________

Attendants: ____________________ ____________________

Rescue Team: ____________________ ____________________

Other: ____________________ ____________________

Permit prepared by: ____________________________

Entry Authorized by (HSO): (Print)____________________ (Signature)____________________

PERMIT CANCELLATION:

Reason: ____

____

HSO Signature: ____________________________

☐ Copy of form sent to Health and Safety Manager, Portland, ME. (manditory)

CONFINED SPACE ENTRY – ALTERNATE PROCEDURES
29 CFR 1910.146

-nate procedures can only be used for confined spaces where ABB–ES has demonstrated, through
iitr g and inspection that: 1) the only hazard posed by the space is an actual or potential hazardous
os e; and 2) Continuous forced air ventilation alone is sufficient to ensure that the space is safe for entry.

Date of Entry: ____________________

Name: ____________________ Location Confined Space: ____________________

Location: ____________________

:ification for using alternate procedures: ____________________

S	NO	N/A	
			1. Do condition exist making it unsafe to open entrance cover? (If yes, unsafe conditions must be eliminated before the cover is removed!)
			2. Has entrance been protected? (e.g., railing, danger tape, etc.) Method being used: ____________________
			3. Internal atmosphere tested with direct reading instruments? (Record results below)
			4. Atmosphere acceptable for entry? (If no, continuous forced air ventilation is manditory!)
			5. Is continuous forced air ventilation being used? (No entry allowed until atmospheric conditions are safe.)
			6. Are the immediate areas where associates are or will be present being ventilated? (If no, move ventilation.)
			7. Is the air supply for the forced air ventilation from a clean source? (If no, provide a clean source of air.)

:CEPTABLE ATMOSPHERIC LEVELS FOR ENTRY:

19.5% = Oxygen

10% = LEL

10⁰' = Hydrogen Sulfide

_____ = PID/FID

_____ = Draeger Tube: ____________________

_____ = Other: ____________________

Ma, .se < 20% LEL as long as precautions are taken (e.g., non–sparking tools, intrinsically safe equipment).

-MOSPHERE TESTING RESULTS: (NOTE: Monitoring must be conducted in the order listed below.)
ecord the time and the results of readings at the Entryway (prior to opening the door or cover), Initial
mosphere (greatest of top, middle, or bottom of space), when the atmosphere has Stabilized after ventilation
:reatest of top, middle, or bottom of space), and periodically thereafter in the workers Breathing Zone.

	Entryway	Initial*	Stabilized	Breathing Zone	Breathing Zone	Breathing Zone	Breathing Zone
ime							
̸ Oxygen							
̸ LEL							
ꟷ.S Meter (ppm)							
ᴾID/FID (ppm)							
Draeger Tube (ppm)							
Tube:							
Other (list)							

If initial readings are acceptable, workers can enter space in Level D without ventilation.

certify that all safety precautions have been taken and that conditions are safe for entry.

Signiture of HSO: ____________________ Date: ____________________

certify that I have reviewed the information provided and the space has been certified as safe for entry.

Si ure of Entrants: ____________________ Date: ____________________

____________________ Date: ____________________

APPENDIX J EXCAVATION AND TRENCHING

J EXCAVATION AND TRENCHING

J.1 EXCAVATION PROCEDURES

Because excavations and trenches pose a hazard to employees, structures, and equipment, all excavations created during site operations will be done in accordance with 29 CFR 1926 Subpart P. The following steps summarize the excavation procedures that will be followed by all ABB Environmental personnel:

- Prior to excavating or trenching, all surface encumbrances located so as to create a hazard to the employees will be removed or supported, and all underground utilities will be determined and located.
- Entry into excavations will be avoided at all costs. If entry is unavoidable, the excavation will be considered a confined space; as such, entry will be done in accordance with the Confined Space Entry Program (see Appendix I).
- Under no circumstances will site personnel enter excavations that are not adequately protected from cave-ins by shoring or sloping.
- Stairways, ladders, or ramps will be located in trenches deeper than 4 feet and situated to require no more than 25 feet of lateral travel.
- Excavations below the base of a building or structure will not be permitted unless the building or structure is adequately supported or a registered professional engineer determines that the excavation will not pose a hazard to the employee.
- All equipment will be kept at least 2 feet from the edge of the excavation.
- Any excavation left open and unattended will be barricaded or covered until it can be backfilled.

J.2 SLOPING

Acceptable options for sloping or benching include the following:

Option 1. A slope of 1½ horizontal to 1 vertical (34 degrees measured from the horizontal).

Option 2. Determination of the maximum allowable slope based on soil conditions and in accordance with the conditions and requirements set forth in 1926 Subpart P, Appendices A and B (see Attachment A).

Option 3. Designs of sloping or benching systems using tabulated data approved by a registered professional engineer.

Option 4. Other systems designed by a registered professional engineer.

J.3 SHORING

Acceptable options for shoring include the following:

Option 1. Designs using Appendices A, C, and D of 1910.126 Subpart P (see Attachment A).

Option 2. Designs using manufacturers tabulated data.

Option 3. Designs using tabulated data approved by a registered professional engineer.

Option 4. Other support systems designed by a registered professional engineer.

ATTACHMENT A

29 CFR 1926 SUBPART P
APPENDICES A THROUGH D

OCCUPATIONAL SAFETY AND HEALTH STANDARDS - EXCAVATIONS

(ii) Installation of a support system shall be closely coordinated with the excavation of trenches.

(f) *Sloping and benching systems.* Employees shall not be permitted to work on the faces of sloped or benched excavations at levels above other employees except when employees at the lower levels are adequately protected from the hazard of falling, rolling, or sliding material or equipment.

(g) *Shield systems*—(1) *General.* (i) Shield systems shall not be subjected to loads exceeding those which the system was designed to withstand.

(ii) Shields shall be installed in a manner to restrict lateral or other hazardous movement of the shield in the event of the application of sudden lateral loads.

(iii) Employees shall be protected from the hazard of cave-ins when entering or exiting the areas protected by shields.

(iv) Employees shall not be allowed in shields when shields are being installed, removed, or moved vertically.

(2) *Additional requirement for shield systems used in trench excavations.* Excavations of earth material to a level not greater than 2 feet (.61 m) below the bottom of a shield shall be permitted, but only if the shield is designed to resist the forces calculated for the full depth of the trench, and there are no indications while the trench is open of a possible loss of soil from behind or below the bottom of the shield.

Appendix A to Subpart P

Soil Classification

(a) *Scope and application*—(1) *Scope.* This appendix describes a method of classifying soil and rock deposits based on site and environmental conditions, and on the structure and composition of the earth deposits. The appendix contains definitions, sets forth requirements, and describes acceptable visual and manual tests for use in classifying soils.

(2) *Application.* This appendix applies when a sloping or benching system is designed in accordance with the requirements set forth in § 1926.652(b)(2) as a method of protection for employees from cave-ins. This appendix also applies when timber shoring for excavations is designed as a method of protection from cave-ins in accordance with appendix C to subpart P of part 1926, and when aluminum hydraulic shoring is designed in accordance with appendix D. This Appendix also applies if other protective systems are designed and selected for use from data prepared in accordance with the requirements set forth in § 1926.652(c), and the use of the data is predicated on the use of the soil classification system set forth in this appendix.

(b) *Definitions.* The definitions and examples given below are based on, in whole or in part, the following: American Society for Testing Materials (ASTM) Standards D653–85 and D2488; The Unified Soils Classification System, The U.S. Department of Agriculture (USDA) Textural Classification Scheme; and The National Bureau of Standards Report BSS–121.

Cemented soil means a soil in which the particles are held together by a chemical agent, such as calcium carbonate, such that a hand-size sample cannot be crushed into powder or individual soil particles by finger pressure.

Cohesive soil means clay (fine grained soil), or soil with a high clay content, which has cohesive strength. Cohesive soil does not crumble, can be excavated with vertical sideslopes, and is plastic when moist. Cohesive soil is hard to break up when dry, and exhibits significant cohesion when submerged. Cohesive soils include clayey silt, sandy clay, silty clay, clay and organic clay.

Dry soil means soil that does not exhibit visible signs of moisture content.

Fissured means a soil material that has a tendency to break along definite planes of fracture with little resistance, or a material that exhibits open cracks, such as tension cracks, in an exposed surface.

Granular soil means gravel, sand, or silt, (coarse grained soil) with little or no clay content. Granular soil has no cohesive strength. Some moist granular soils exhibit apparent cohesion. Granular soil cannot be molded when moist and crumbles easily when dry.

Layered system means two or more distinctly different soil or rock types arranged in layers. Micaceous seams or weakened planes in rock or shale are considered layered.

Moist soil means a condition in which a soil looks and feels damp. Moist cohesive soil can easily be shaped into a ball and rolled into small diameter threads before crumbling. Moist granular soil that contains some cohesive material will exhibit signs of cohesion between particles.

Plastic means a property of a soil which allows the soil to be deformed or molded without cracking, or appreciable volume change.

Saturated soil means a soil in which the voids are filled with water. Saturation does not require flow. Saturation, or near saturation, is necessary for the proper use of instruments such as a pocket penetrometer or sheer vane.

Soil classification system means, for the purpose of this subpart, a method of categorizing soil and rock deposits in a hierarchy of Stable Rock, Type A, Type B, and Type C, in decreasing order of stability. The categories are determined based on an analysis of the properties and performance characteristics of the deposits and the environmental conditions of exposure.

Stable rock means natural solid mineral matter that can be excavated with vertical sides and remain intact while exposed.

Submerged soil means soil which is underwater or is free seeping.

Type A means cohesive soils with an unconfined compressive strength of 1.5 ton per square foot (tsf) (144 kPa) or greater. Examples of cohesive soils are: clay, silty clay, sandy clay, clay loam and, in some cases, silty clay loam and sandy clay loam. Cemented soils such as caliche and hardpan are also considered Type A. However, no soil is Type A if:

(i) The soil is fissured; or

(ii) The soil is subject to vibration from heavy traffic, pile driving, or similar effects; or

(iii) The soil has been previously disturbed; or

(iv) The soil is part of a sloped, layered system where the layers dip into the excavation on a slope of four horizontal to one vertical (4H:1V) or greater; or

(v) The material is subject to other factors that would require it to be classified as a less stable material.

Type B means:

(i) Cohesive soil with an unconfined compressive strength greater than 0.5 tsf (48 kPa) but less than 1.5 tsf (144 kPa); or

(ii) Granular cohesionless soils including: angular gravel (similar to crushed rock), silt, silt loam, sandy loam and, in some cases, silty clay loam and sandy clay loam.

(iii) Previously disturbed soils except those which would otherwise be classed as Type C soil.

(iv) Soil that meets the unconfined compressive strength or cementation requirements for Type A, but is fissured or subject to vibration; or

(v) Dry rock that is not stable; or

(vi) Material that is part of a sloped, layered system where the layers dip into the excavation on a slope less steep than four horizontal to one vertical (4H:1V), but only if the material would otherwise be classified as Type B.

Type C means:

(i) Cohesive soil with an unconfined compressive strength of 0.5 tsf (48 kPa) or less; or

(ii) Granular soils including gravel, sand, and loamy sand; or

(iii) Submerged soil or soil from which water is freely seeping; or

(iv) Submerged rock that is not stable, or

(v) Material in a sloped, layered system where the layers dip into the excavation or a slope of four horizontal to one vertical (4H:1V) or steeper.

Unconfined compressive strength means the load per unit area at which a soil will fail in compression. It can be determined by laboratory testing, or estimated in the field using a pocket penetrometer, by thumb penetration tests, and other methods.

Wet soil means soil that contains significantly more moisture than moist soil, but in such a range of values that cohesive material will slump or begin to flow when vibrated. Granular material that would exhibit cohesive properties when moist will lose those cohesive properties when wet.

(c) *Requirements*—(1) *Classification of soil and rock deposits.* Each soil and rock deposit shall be classified by a competent person as Stable Rock, Type A, Type B, or Type C in accordance with the definitions set forth in paragraph (b) of this appendix.

(2) *Basis of classification.* The classification of the deposits shall be made based on the results of at least one visual and at least one manual analysis. Such analyses

shall be conducted by a competent person using tests described in paragraph (d) below, or in other recognized methods of soil classification and testing such as those adopted by the America Society for Testing Materials, or the U.S. Department of Agriculture textural classification system.

(3) *Visual and manual analyses.* The visual and manual analyses, such as those noted as being acceptable in paragraph (d) of this appendix, shall be designed and conducted to provide sufficient quantitative and qualitative information as may be necessary to identify properly the properties, factors, and conditions affecting the classification of the deposits.

(4) *Layered systems.* In a layered system, the system shall be classified in accordance with its weakest layer. However, each layer may be classified individually where a more stable layer lies under a less stable layer.

(5) *Reclassification.* If, after classifying a deposit, the properties, factors, or conditions affecting its classification change in any way, the changes shall be evaluated by a competent person. The deposit shall be reclassified as necessary to reflect the changed circumstances.

(d) *Acceptable visual and manual tests.*—(1) *Visual tests.* Visual analysis is conducted to determine qualitative information regarding the excavation site in general, the soil adjacent to the excavation, the soil forming the sides of the open excavation, and the soil taken as samples from excavated material.

(i) Observe samples of soil that are excavated and soil in the sides of the excavation. Estimate the range of particle sizes and the relative amounts of the particle sizes. Soil that is primarily composed of fine-grained material is cohesive material. Soil composed primarily of coarse-grained sand or gravel is granular material.

(ii) Observe soil as it is excavated. Soil that remains in clumps when excavated is cohesive. Soil that breaks up easily and does not stay in clumps is granular.

(iii) Observe the side of the opened excavation and the surface area adjacent to the excavation. Crack-like openings such as tension cracks could indicate fissured material. If chunks of soil spall off a vertical side, the soil could be fissured. Small spalls are evidence of moving ground and are indications of potentially hazardous situations.

(iv) Observe the area adjacent to the excavation and the excavation itself for evidence of existing utility and other underground structures, and to identify previously disturbed soil.

(v) Observe the opened side of the excavation to identify layered systems. Examine layered systems to identify if the layers slope toward the excavation. Estimate the degree of slope of the layers.

(vi) Observe the area adjacent to the excavation and the sides of the opened excavation for evidence of surface water, water seeping from the sides of the excavation, or the location of the level of the water table.

(vii) Observe the area adjacent to the excavation and the area within the excavation for sources of vibration that may affect the stability of the excavation face.

(2) *Manual tests.* Manual analysis of soil samples is conducted to determine quantitative as well as qualitative properties of soil and to provide more information in order to classify soil properly.

(i) *Plasticity.* Mold a moist or wet sample of soil into a ball and attempt to roll it into threads as thin as ⅛-inch in diameter. Cohesive material can be successfully rolled into threads without crumbling. For example, if at least a two inch (50 mm) length of ⅛-inch thread can be held on one end without tearing, the soil is cohesive.

(ii) *Dry strength.* If the soil is dry and crumbles on its own or with moderate pressure into individual grains or fine powder, it is granular (any combination of gravel, sand, or silt). If the soil is dry and falls into clumps which break up into smaller clumps, but the smaller clumps can only be broken up with difficulty, it may be clay in any combination with gravel, sand or silt. If the dry soil breaks into clumps which do not break up into small clumps and which can only be broken with difficulty, and there is no visual indication the soil is fissured, the soil may be considered unfissured.

(iii) *Thumb penetration.* The thumb penetration test can be used to estimate the unconfined compressive strength of cohesive soils. (This test is based on the thumb penetration test described in American Society for Testing and Materials (ASTM) Standard designation D2488—"Standard Recommended Practice for Description of Soils (Visual—Manual Procedure).") Type A soils with an unconfined compressive strength of 1.5 tsf can be readily indented by the thumb; however, they can be penetrated by the thumb only with very great effort. Type C soils with an unconfined compressive strength of 0.5 tsf can be easily penetrated several inches by the thumb, and can be molded by light finger pressure. This test should be conducted on an undisturbed soil sample, such as a large clump of spoil, as soon as practicable after excavation to keep to a minimum the effects of exposure to drying influences. If the excavation is later exposed to wetting influences (rain, flooding), the classification of the soil must be changed accordingly.

(iv) *Other strength tests.* Estimates of unconfined compressive strength of soils can also be obtained by use of a pocket penetrometer or by using a hand-operated shearvane.

(v) *Drying test.* The basic purpose of the drying test is to differentiate between cohesive material with fissures, unfissured cohesive material, and granular material. The procedure for the drying test involves drying a sample of soil that is approximately one inch thick (2.54 cm) and six inches (15.24 cm) in diameter until it is thoroughly dry:

(A) If the sample develops cracks as it dries, significant fissures are indicated.

(B) Samples that dry without cracking are to be broken by hand. If considerable force is necessary to break a sample, the soil has significant cohesive material content. The soil can be classified as a unfissured cohesive material and the unconfined compressive strength should be determined.

(C) If a sample breaks easily by hand, it is either a fissured cohesive material or a granular material. To distinguish between the two, pulverize the dried clumps of the sample by hand or by stepping on them. If the clumps do not pulverize easily, the material is cohesive with fissures. If they pulverize easily into very small fragments, the material is granular.

Appendix B to Subpart P

Sloping and Benching

(a) *Scope and application.* This appendix contains specifications for sloping and benching when used as methods of protecting employees working in excavations from cave-ins. The requirements of this appendix apply when the design of sloping and benching protective systems is to be performed in accordance with the requirements set forth in § 1926.652(b)(2).

(b) *Definitions.*

Actual slope means the slope to which an excavation face is excavated.

Distress means that the soil is in a condition where a cave-in is imminent or is likely to occur. Distress is evidenced by such phenomena as the development of fissures in the face of or adjacent to an open excavation; the subsidence of the edge of an excavation; the slumping of material from the face or the bulging or heaving of material from the bottom of an excavation; the spalling of material from the face of an excavation; and ravelling, i.e., small amounts of material such as pebbles or little clumps of material suddenly separating from the face of an excavation and trickling or rolling down into the excavation.

Maximum allowable slope means the steepest incline of an excavation face that is acceptable for the most favorable site conditions as protection against cave-ins, and is expressed as the ratio of horizontal distance to vertical rise (H:V).

Short term exposure means a period of time less than or equal to 24 hours that an excavation is open.

(c) *Requirements*—(1) *Soil classification.* Soil and rock deposits shall be classified in accordance with appendix A to subpart P of part 1926.

(2) *Maximum allowable slope.* The maximum allowable slope for a soil or rock deposit shall be determined from Table B-1 of this appendix.

(3) *Actual slope.* (i) The actual slope shall not be steeper than the maximum allowable slope.

(ii) The actual slope shall be less steep than the maximum allowable slope, when there are signs of distress. If that situation occurs, the slope shall be cut back to an actual slope which is at least ½ horizontal to one vertical (½H:1V) less steep than the maximum allowable slope.

(iii) When surcharge loads from stored material or equipment, operating equipment, or traffic are present, a competent person shall determine the degree to which the actual slope must be reduced below the maximum allowable slope, and shall assure that such reduction is achieved. Surcharge loads from adjacent structures shall be evaluated in accordance with § 1926.651(i).

(4) *Configurations.* Configurations of sloping and benching systems shall be in accordance with Figure B-1.

TABLE B-1

MAXIMUM ALLOWABLE SLOPES

SOIL OR ROCK TYPE	MAXIMUM ALLOWABLE SLOPES (H:V) [1] FOR EXCAVATIONS LESS THAN 20 FEET DEEP [3]
STABLE ROCK TYPE A [2] TYPE B TYPE C	VERTICAL (90°) 3/4:1 (53°) 1:1 (45°) 1½:1 (34°)

NOTES:

1. Numbers shown in parentheses next to maximum allowable slopes are angles expressed in degrees from the horizontal. Angles have been rounded off.
2. A short-term maximum allowable slope of 1/2H:1V (63°) is allowed in excavations in Type A soil that are 12 feet (3.67 m) or less in depth. Short-term maximum allowable slopes for excavations greater than 12 feet (3.67 m) in depth shall be 3/4H:1V (53°).
3. Sloping or benching for excavations greater than 20 feet deep shall be designed by a registered professional engineer.

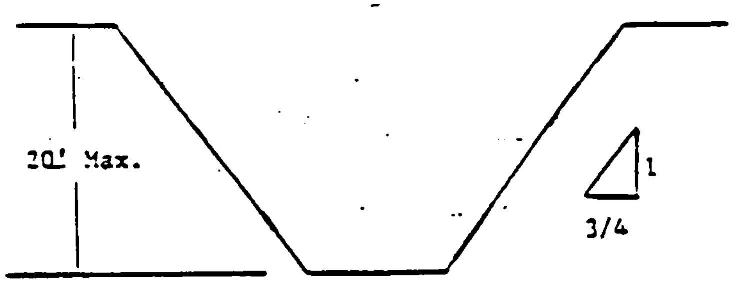
Figure B-.

Slope Configurations

(All slopes stated below are in the horizontal to vertical ratio)

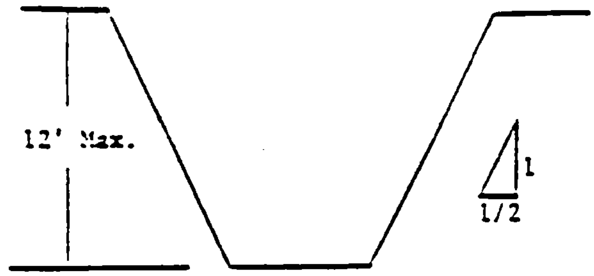
B-1.1 Excavations made in Type A soil.

1. All simple slope excavation 20 feet or less in depth shall have a maximum allowable slope of ¾:1.



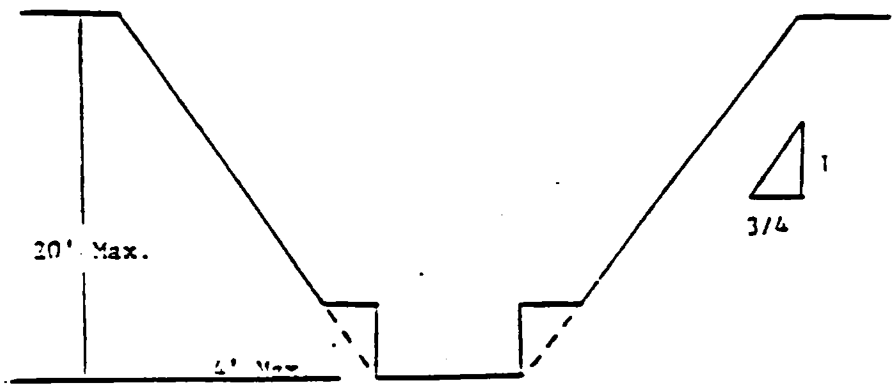
Simple Slope—General

Exception: Simple slope excavations which are open 24 hours or less (short term) and which are 12 feet or less in depth shall have a maximum allowable slope of ½:1.

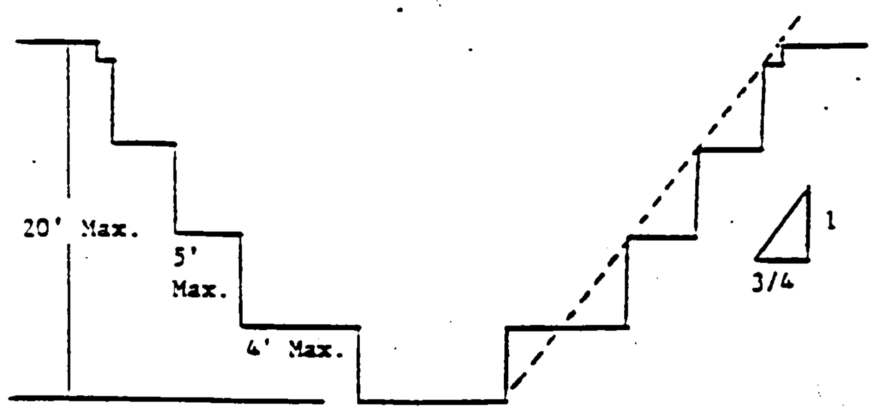


Simple Slope—Short Term

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of ¾ to 1 and maximum bench dimensions as follows:

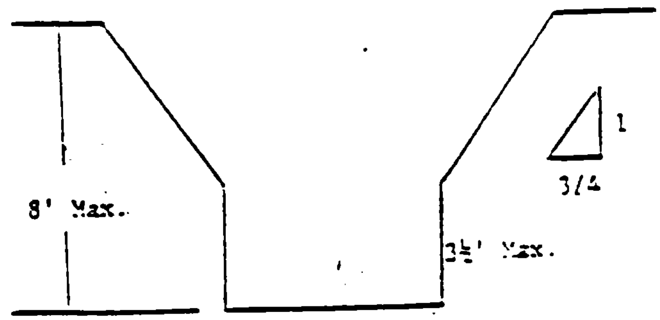


Simple Bench



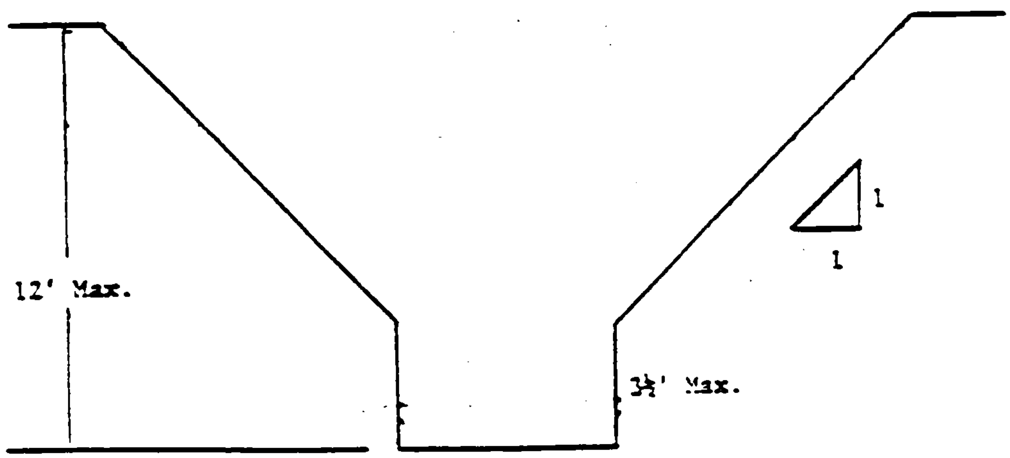
Multiple Bench

3. All excavations 8 feet or less in depth which have unsupported vertically sided lower portions shall have a maximum vertical side of 3½ feet.



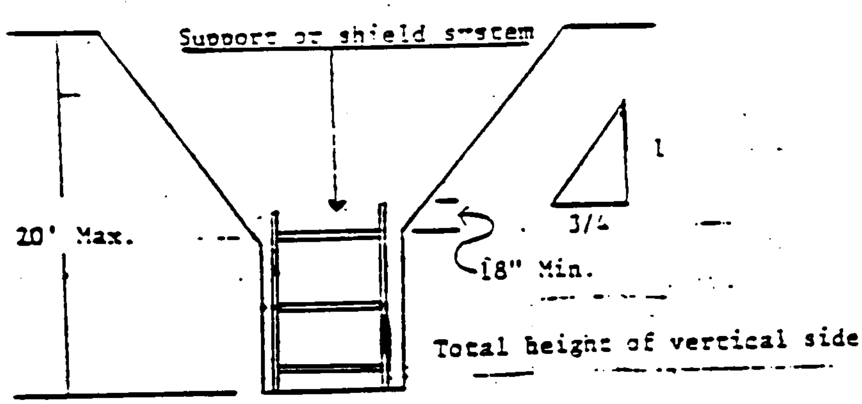
Unsupported Vertically Sided Lower Portion—Maximum 8 Feet in Depth

All excavations more than 8 feet but not more than 12 feet in depth which unsupported vertically sided lower portions shall have a maximum allowable slope of 1:1 and a maximum vertical side of 3½ feet.



Unsupported Vertically Sided Lower Portion—Maximum 12 Feet in Depth

All excavations 20 feet or less in depth which have vertically sided lower portions that are supported or shielded shall have a maximum allowable slope of ¾:1. The support or shield system must extend at least 18 inches above the top of the vertical side.

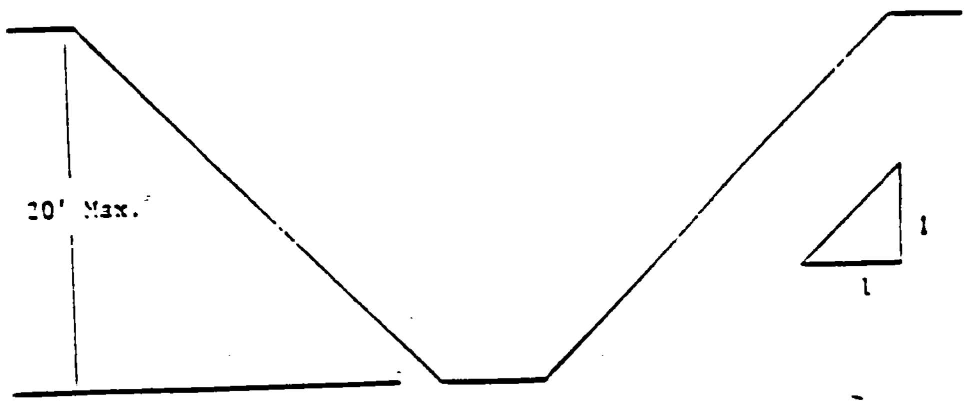


Supported or Shielded Vertically Sided Lower Portion

4. All other simple slope, compound slope, and vertically sided lower portion excavations shall be in accordance with the other options permitted under § 1926.652(b).

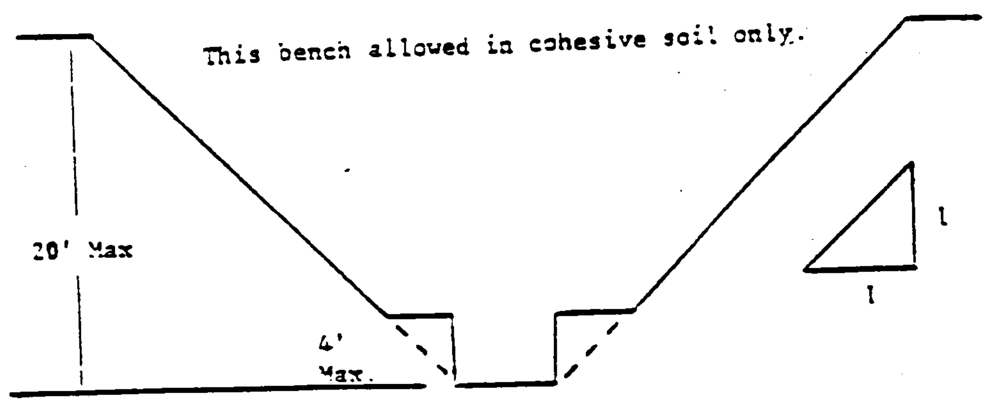
B-1.2 Excavations Made in Type B Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1.

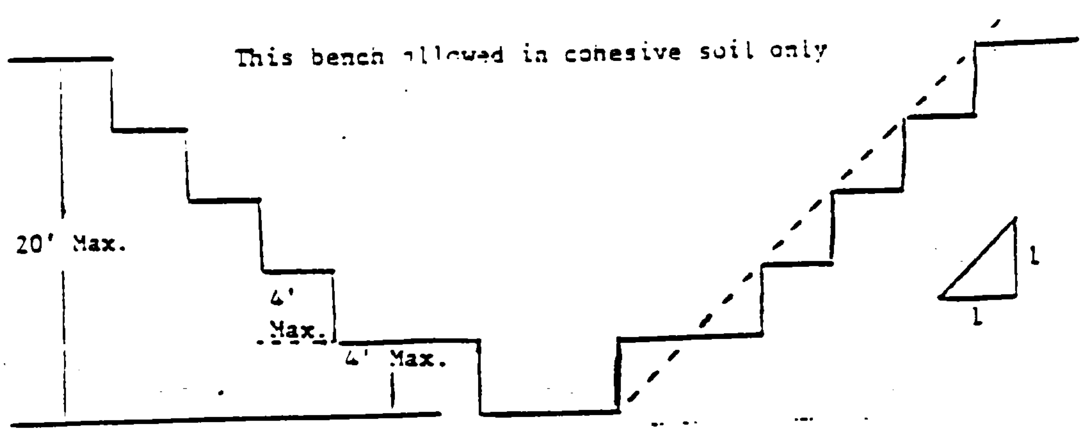


Simple Slope

2. All benched excavations 20 feet or less in depth shall have a maximum allowable slope of 1:1 and maximum bench dimensions as follows:

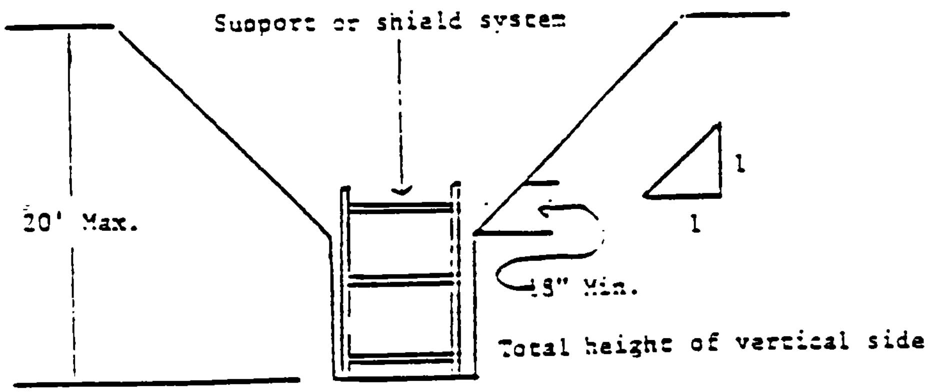


Single Bench



Multiple Bench

3. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1:1.

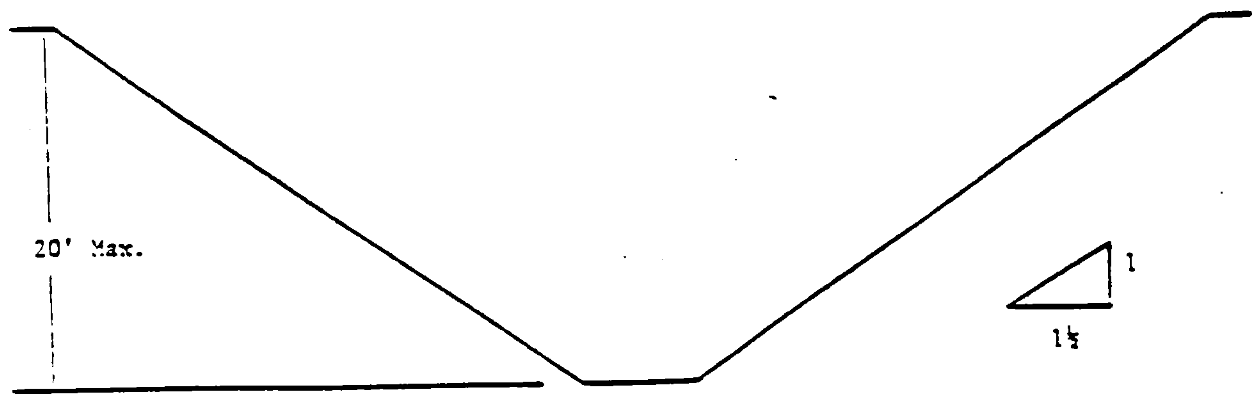


Vertically Sided Lower Portion

4. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

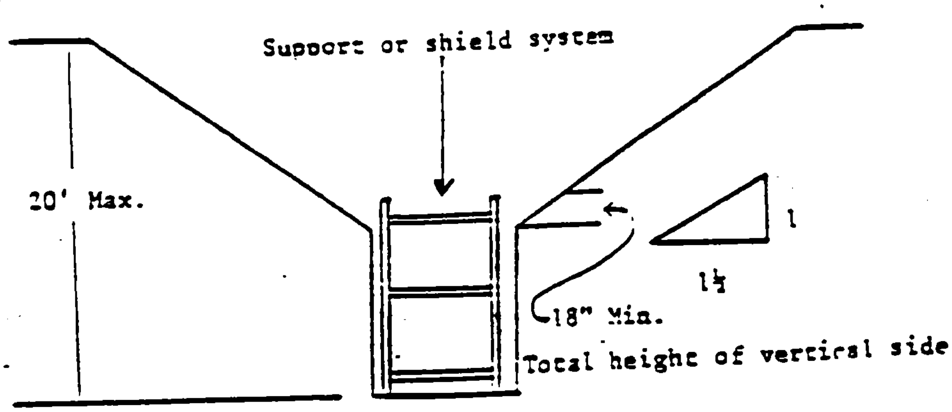
B-1.3 Excavations Made in Type C Soil

1. All simple slope excavations 20 feet or less in depth shall have a maximum allowable slope of 1½:1.



Simple Slope

2. All excavations 20 feet or less in depth which have vertically sided lower portions shall be shielded or supported to a height at least 18 inches above the top of the vertical side. All such excavations shall have a maximum allowable slope of 1½:1.

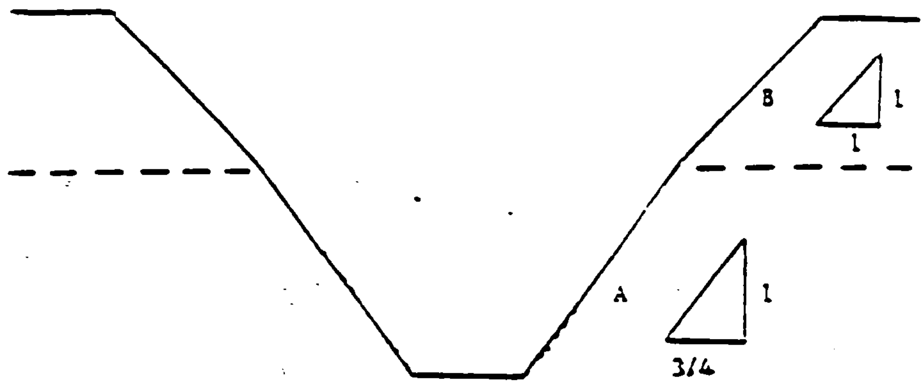


Vertical Sided Lower Portion

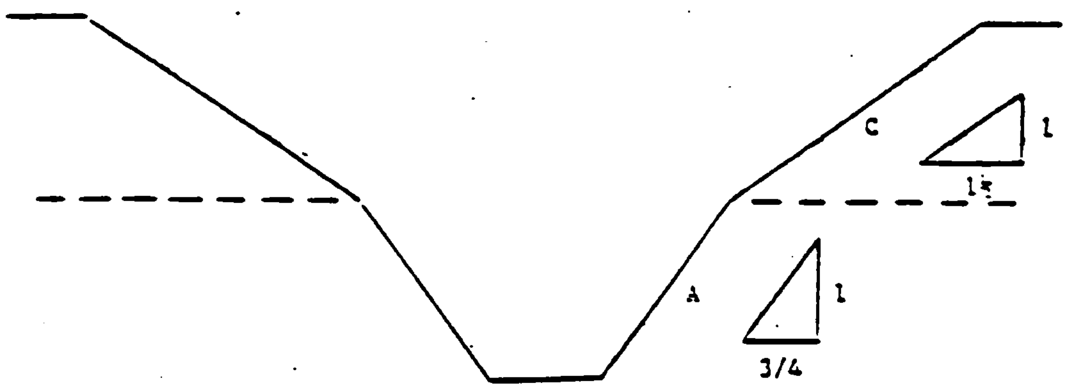
3. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

B-1.4 Excavations Made in Layered Soils

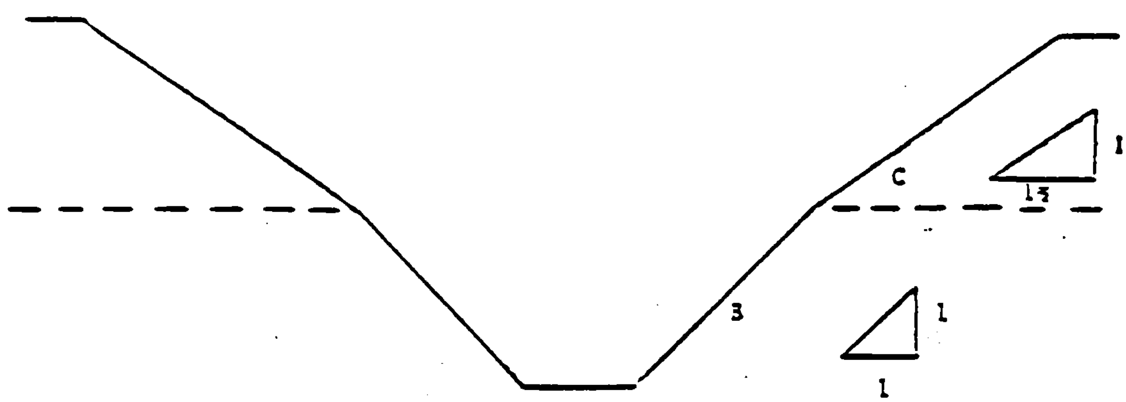
1. All excavations 20 feet or less in depth made in layered soils shall have a maximum allowable slope for each layer as set forth below.



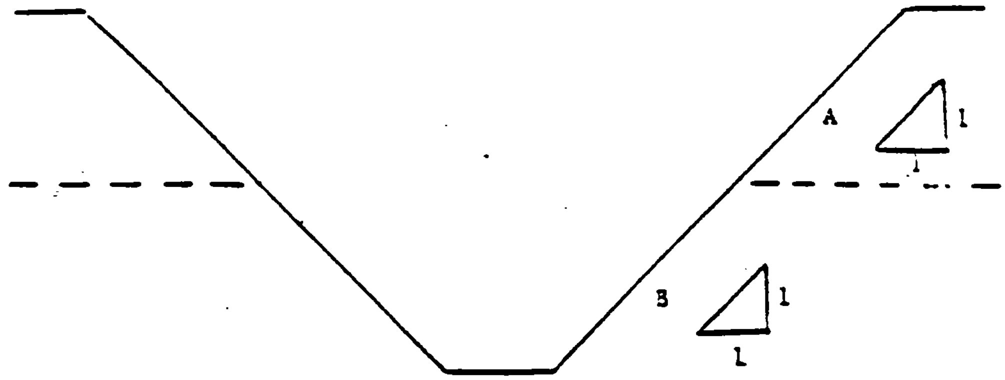
B OVER A



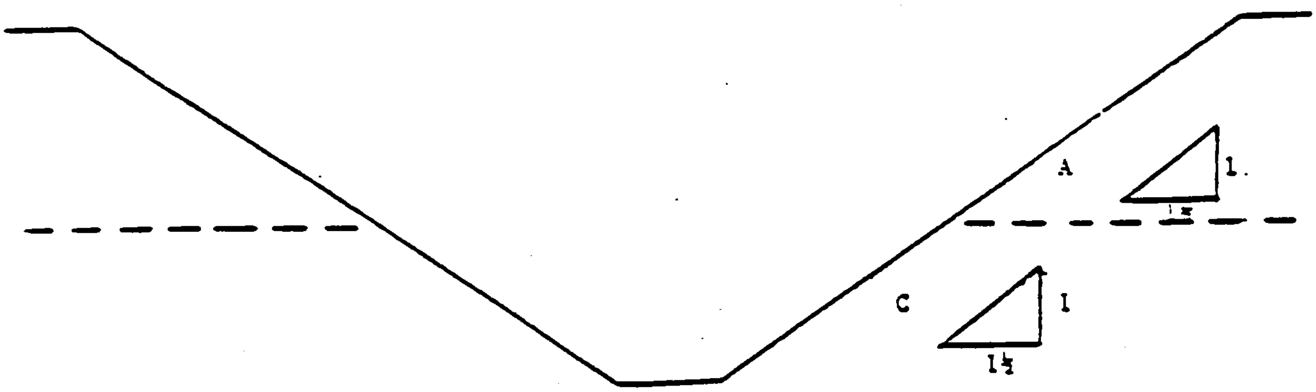
C OVER A



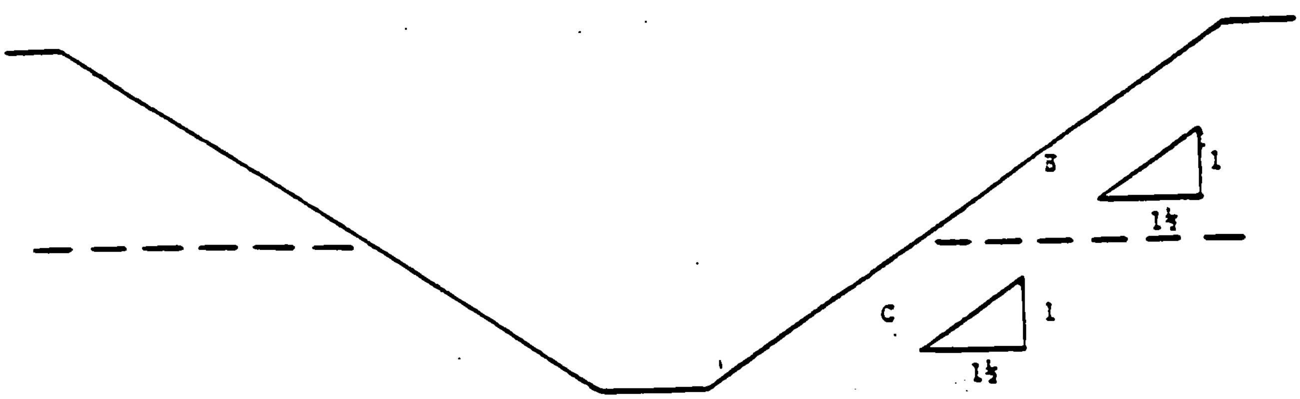
C OVER B



A OVER B



A OVER C



B OVER C

2. All other sloped excavations shall be in accordance with the other options permitted in § 1926.652(b).

Appendix C to Subpart P

Timber Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used timber shoring is provided as a method of protection from cave-ins in trenches that do not exceed 20 feet (6.1 m) in depth. This appendix must be used when design of timber shoring protective systems is to be performed in accordance with § 1926.652(c)(1). Other timber shoring configurations; other systems of support such as hydraulic and pneumatic systems; and other protective systems such as sloping, benching, shielding, and freezing systems must be designed in accordance with the requirements set forth in § 1926.652(b) and § 1926.652(c).

(b) *Soil Classification.* In order to use the data presented in this appendix, the soil typ or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of this part.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables C-1.1, C-1.2, and C-1.3, and Tables C-2.1, C-2.2 and C-2.3 following paragraph (g) of the appendix. Each table presents the minimum sizes of timber members to use in a shoring system, and each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. The data are arranged to allow the user the flexibility to select from among several acceptable configurations of members based on varying the horizontal spacing of the crossbraces. Stable rock is exempt from shoring requirements and therefore, no data are presented for this condition.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix, and on the tables themselves.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations regarding Tables C-1.1 through C-1.3 and Tables C-2.1 through C-2.3 are presented in paragraph (g) of this Appendix.

(d) *Basis and limitations of the data.*—(1) *Dimensions of timber members.* (i) The sizes of the timber members listed in Tables C-1.1 through C-1.3 are taken from the National Bureau of Standards (NBS) report, "Recommended Technical Provisions for Construction Practice in Shoring and Sloping of Trenches and Excavations." In addition, where NBS did not recommend specific sizes of members, member sizes are based on an analysis of the sizes required for use by existing codes and on empirical practice.

(ii) The required dimensions of the members listed in Tables C-1.1 through C-1.3 refer to actual dimensions and not nominal dimensions of the timber. Employers wanting to use nominal size shoring are directed to Tables C-2.1 through C-2.3, or have this choice under § 1926.652(c)(3), and are referred to The Corps of Engineers, The Bureau of Reclamation or data from other acceptable sources.

(2) *Limitation of application.* (i) It is not intended that the timber shoring specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the tables are not considered adequate. Either an alternate timber shoring system must be designed or another type of protective system designed in accordance with § 1926.652.

(A) When loads imposed by structures or by stored material adjacent to the trench weigh in excess of the load imposed by a two-foot soil surcharge. The term "adjacent" as used here means the area within a horizontal distance from the edge of the trench equal to the depth of the trench.

(B) When vertical loads imposed on cross braces exceed a 240-pound gravity load distributed on a one-foot section of the center of the crossbrace.

(C) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(D) When only the lower portion of a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables.* The members of the shoring system that are to be selected using this information are the cross braces, the uprights, and the wales, where wales are required. Minimum sizes of members are specified for use in different types of soil. There are six tables of information, two for each soil type. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is then made. The selection is based on the depth and width of the trench where the members are to be installed and, in most instances, the selection is also based on the horizontal spacing of the crossbraces. Instances where a choice of horizontal spacing of crossbracing is available, the horizontal spacing of the crossbraces must be chosen by the user before the size of any member can be determined. When the soil type, the width and depth of the trench, and the horizontal spacing of the crossbraces are known, the size and vertical spacing of the crossbraces, the size and vertical spacing of the wales, and the size and horizontal spacing of the uprights can be read from the appropriate table.

(f) *Examples to Illustrate the Use of Tables C-1.1 through C-1.3.*

(1) *Example 1.*

A trench dug in Type A soil is 13 feet deep and five feet wide.

From *Table C-1.1*, for acceptable arrangements of timber can be used.

Arrangement #1

Space 4×4 crossbraces at six feet horizontally and four feet vertically.

Wales are not required.

Space 3×8 uprights at six feet horizontally. This arrangement is commonly called "skip shoring."

Arrangement #2

Space 4×6 crossbraces at eight feet horizontally and four feet vertically.

Space 8×8 wales at four feet vertically.

Space 2×6 uprights at four feet horizontally.

Arrangement #3

Space 6×6 crossbraces at 10 feet horizontally and four feet vertically.

Space 8×10 wales at four feet vertically.

Space 2×6 uprights at five feet horizontally.

Arrangement #4

Space 6×6 crossbraces at 12 feet horizontally and four feet vertically.

Space 10×10 wales at four feet vertically.

Spaces 3×8 uprights at six feet horizontally.

(2) *Example 2.*

A trench dug in Type B soil in 13 feet deep and five feet wide. From Table C-1.2 three acceptable arrangements of members are listed.

Arrangement #1

Space 6×6 crossbraces at six feet horizontally and five feet vertically.

Space 8×8 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #2

Space 6×8 crossbraces at eight feet horizontally and five feet vertically.

Space 10×10 wales at five feet vertically.

Space 2×6 uprights at two feet horizontally.

Arrangement #3

Space 8×8 crossbraces at 10 feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Space 2×6 uprights at two feet vertically.

(3) *Example 3.*

A trench dug in Type C soil is 13 feet deep and five feet wide.

From Table C-1.3 two acceptable arrangements of members can be used.

Arrangement #1

Space 8×8 crossbraces at six feet horizontally and five feet vertically.

Space 10×12 wales at five feet vertically.

Position 2×6 uprights as closely together as possible.

If water must be retained use special tongue and groove uprights to form tight sheeting.

Arrangement #2

Space 8×10 crossbraces at eight feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Position 2×6 uprights in a close sheeting configuration unless water pressure must be resisted. Tight sheeting must be used where water must be retained.

(4) *Example 4.*

A trench dug in Type C soil is 20 feet deep and 11 feet wide. The size and spacing of members for the section of trench that is over 15 feet in depth is determined using Table C-1.3. Only one arrangement of members is provided.

Space 8×10 crossbraces at six feet horizontally and five feet vertically.

Space 12×12 wales at five feet vertically.

Use 3×6 tight sheeting.

Use of Tables C-2.1 through C-2.3 would follow the same procedures.

(g) *Notes for all Tables.*

1. Member sizes at spacings other than indicated are to be determined as specified in § 1926.652(c), "Design of Protective Systems."

2. When conditions are saturated or submerged use Tight Sheeting. Tight Sheeting refers to the use of specially-edged timber planks (e.g., tongue and groove) at least three inches thick, steel sheet piling, or similar construction that when driven or placed in position provide a tight wall to resist the lateral pressure of water and to prevent the loss of backfill material. Close Sheeting refers to the placement of planks side-by-side allowing as little space as possible between them.

3. All spacing indicated is measured center to center.

4. Wales to be installed with greater dimension horizontal.

5. If the vertical distance from the center of the lowest crossbrace to the bottom of the trench exceeds two and one-half feet, uprights shall be firmly embedded or a mudsill shall be used. Where uprights are embedded, the vertical distance from the center of the lowest crossbrace to the bottom of the trench shall not exceed 36 inches. When mudsills are used, the vertical distance shall not exceed 42 inches. Mudsills are wales that are installed at the toe of the trench side.

6. Trench jacks may be used in lieu of or in combination with timber crossbraces.

7. Placement of crossbraces. When the vertical spacing of crossbraces is four feet, place the top crossbrace no more than two feet below the top of the trench. When the vertical spacing of crossbraces is five feet, place the top crossbrace no more than 2.5 feet below the top of the trench.

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TABLE C-1.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A $P_a = 25 \times H + 72$ psf (2 ft Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				2X6	
	UP TO 8	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---					2X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			2X6		
	UP TO 12	4X6	4X6	6X6	6X6	6X6	4	8X8	4				2X6	
10 TO 15	UP TO 6	4X4	4X4	4X6	6X6	6X6	4	Not Req'd	---				3X8	
	UP TO 8	4X6	4X6	6X6	6X6	6X6	4	8X8	4		2X6			
	UP TO 10	6X6	6X6	6X6	6X8	6X8	4	8X10	4			2X6		
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	10X10	4				3X8	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X8	6X8	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X8	6X8	4	8X8	4	3X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X10	4	8X10	4	3X6				
	UP TO 12	8X8	8X8	8X8	8X8	8X10	4	10X10	4	3X6				
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.

** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	2	3		
5 TO 10	UP TO 6	4X6	4X6	6X6	6X6	6X6	5	6X8	5			2X6		
	UP TO 8	6X6	6X6	6X6	6X8	6X8	5	8X10	5			2X6		
	UP TO 10	6X6	6X6	6X6	6X8	6X8	5	10X10	5			2X6		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5		2X6			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5		2X6			
	UP TO 10	8X8	8X8	8X8	8X8	8X10	5	10X12	5		2X6			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	3X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	3X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may by substituted for wood.

TABLE C-1.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C $P_a = 80 \times H + 72$ psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (ACTUAL) AND SPACING OF MEMBERS**													
	CROSS BRACES									UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) (See Note 2)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE				
5 TO 10	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	8X10	5	2X6				
	UP TO 8	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 10	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
10 TO 15	UP TO 6	8X8	8X8	8X8	8X8	8X10	5	10X12	5	2X6				
	UP TO 8	8X10	8X10	8X10	8X10	10X10	5	12X12	5	2X6				
	See Note 1													
	See Note 1													
15 TO 20	UP TO 6	8X10	8X10	8X10	8X10	10X10	5	12X12	5	3X6				
	See Note 1													
	See Note 1													
	See Note 1													
OVER 20	SEE NOTE 1													

* Mixed Oak or equivalent with a bending strength not less than 850 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.1

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE A P_a = 25 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **													
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)				
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE	4	5	6	8
5 TO 10	UP TO 6	4X4	4X4	4X4	4X4	4X6	4	Not Req'd	Not Req'd				4X6	
	UP TO 8	4X4	4X4	4X4	4X6	4X6	4	Not Req'd	Not Req'd					4X8
	UP TO 10	4X6	4X6	4X6	6X6	6X6	4	8X8	4			4X6		
	UP TO 12	4X6	4X6	4X6	6X6	6X6	4	8X8	4				4X6	
10 TO 15	UP TO 6	4X4	4X4	4X4	6X6	6X6	4	Not Req'd	Not Req'd				4X10	
	UP TO 8	4X6	4X6	4X6	6X6	6X6	4	6X8	4		4X6			
	UP TO 10	6X6	6X6	6X6	6X6	6X6	4	8X8	4			4X8		
	UP TO 12	6X6	6X6	6X6	6X6	6X6	4	8X10	4		4X6		4X10	
15 TO 20	UP TO 6	6X6	6X6	6X6	6X6	6X6	4	6X8	4	3X6				
	UP TO 8	6X6	6X6	6X6	6X6	6X6	4	8X8	4	3X6	4X12			
	UP TO 10	6X6	6X6	6X6	6X6	6X8	4	8X10	4	3X6				
	UP TO 12	6X6	6X6	6X6	6X8	6X8	4	8X12	4	3X6	4X12			
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.2

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE B P_a = 45 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **														
	CROSS BRACES							WALES		UPRIGHTS				
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET) UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15	VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET) CLOSE	2	3	4	6
5 TO 10	UP TO 6	4X6	4X6	4X6	6X6	6X6	5	6X8	5			3X12 4X8		4X12
	UP TO 8	4X6	4X6	6X6	6X6	6X6	5	8X8	5		3X8		4X8	
	UP TO 10	4X6	4X6	6X6	6X6	6X8	5	8X10	5			4X8		
	See Note 1													
10 TO 15	UP TO 6	6X6	6X6	6X6	6X8	6X8	5	8X8	5	3X6	4X10			
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X10	5	3X6	4X10			
	UP TO 10	6X8	6X8	8X8	8X8	8X8	5	10X12	5	3X6	4X10			
	See Note 1													
15 TO 20	UP TO 6	6X8	6X8	6X8	6X8	8X8	5	8X10	5	4X6				
	UP TO 8	6X8	6X8	6X8	8X8	8X8	5	10X12	5	4X6				
	UP TO 10	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6				
	See Note 1													
OVER 20	SEE NOTE 1													

* Douglas fir or equivalent with a bending strength not less than 1500 psi.
** Manufactured members of equivalent strength may be substituted for wood.

TABLE C-2.3

TIMBER TRENCH SHORING -- MINIMUM TIMBER REQUIREMENTS *

SOIL TYPE C P_a = 80 X H + 72 psf (2 ft. Surcharge)

DEPTH OF TRENCH (FEET)	SIZE (S4S) AND SPACING OF MEMBERS **														
	CROSS BRACES							WALES		UPRIGHTS					
	HORIZ. SPACING (FEET)	WIDTH OF TRENCH (FEET)					VERT. SPACING (FEET)	SIZE (IN)	VERT. SPACING (FEET)	MAXIMUM ALLOWABLE HORIZONTAL SPACING (FEET)					
		UP TO 4	UP TO 6	UP TO 9	UP TO 12	UP TO 15				CLOSE					
5 TO 10	UP TO 6	6X6	6X6	6X6	6X6	8X8	5	8X8	5	3X6					
	UP TO 8	6X6	6X6	6X6	8X8	8X8	5	10X10	5	3X6					
	UP TO 10	6X6	6X6	8X8	8X8	8X8	5	10X12	5	3X6					
	See Note 1														
10 TO 15	UP TO 6	6X8	6X8	6X8	8X8	8X8	5	10X10	5	4X6					
	UP TO 8	8X8	8X8	8X8	8X8	8X8	5	12X12	5	4X6					
	See Note 1														
	See Note 1														
15 TO 20	UP TO 6	8X8	8X8	8X8	8X10	8X10	5	10X12	5	4X6					
	See Note 1														
	See Note 1														
	See Note 1														
OVER 20	SEE NOTE 1														

* Douglas fir or equivalent with a bending strength not less than 1500 psi.

** Manufactured members of equivalent strength may be substituted for wood.

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Appendix D to Subpart P

Aluminum Hydraulic Shoring for Trenches

(a) *Scope.* This appendix contains information that can be used when aluminum hydraulic shoring is provided as a method of protection against cave-ins in trenches that do not exceed 20 feet (6.1m) in depth. This appendix must be used when design of the aluminum hydraulic protective system cannot be performed in accordance with § 1926.652(c)(2).

(b) *Soil Classification.* In order to use data presented in this appendix, the soil type or types in which the excavation is made must first be determined using the soil classification method set forth in appendix A of subpart P of part 1926.

(c) *Presentation of Information.* Information is presented in several forms as follows:

(1) Information is presented in tabular form in Tables D–1.1, D–1.2, D–1.3 and E–1.4. Each table presents the maximum vertical and horizontal spacings that may be used with various aluminum member sizes and various hydraulic cylinder sizes. Each table contains data only for the particular soil type in which the excavation or portion of the excavation is made. Tables D–1.1 and D–1.2 are for vertical shores in Types A and B soil. Tables D–1.3 and D1.4 are for horizontal waler systems in Types B and C soil.

(2) Information concerning the basis of the tabular data and the limitations of the data is presented in paragraph (d) of this appendix.

(3) Information explaining the use of the tabular data is presented in paragraph (e) of this appendix.

(4) Information illustrating the use of the tabular data is presented in paragraph (f) of this appendix.

(5) Miscellaneous notations (footnotes) regarding Table D–1.1 through D–1.4 are presented in paragraph (g) of this appendix.

(6) Figures, illustrating typical installations of hydraulic shoring, are included just prior to the Tables. The illustrations page is entitled "Aluminum Hydraulic Shoring; Typical Installations."

(d) *Basis and limitations of the data.*

(1) Vertical shore rails and horizontal wales are those that meet the Section Modulus requirements in the D–1 Tables. Aluminum material is 6061–T6 or material of equivalent strength and properties.

(2) Hydraulic cylinders specifications. (i) 2-inch cylinders shall be a minimum 2-inch inside diameter with a minimum safe working capacity of no less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufaturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe working capacity of not less than 30,000 pounds axial compressive load at extensions as recommended by product manufacturer.

(3) Limitation of application.

(i) It is not intended that the aluminum hydraulic specification apply to every situation that may be experienced in the field. These data were developed to apply to the situations that are most commonly experienced in current trenching practice. Shoring systems for use in situations that are not covered by the data in this appendix must be otherwise designed as specified in § 1926.652(c).

(ii) When any of the following conditions are present, the members specified in the Tables are not considered adequate. In this case, an alternative aluminum hydraulic shoring system or other type of protective system must be designed in accordance with § 1926.652.

(A) When vertical loads imposed on cross braces exceed a 100 Pound gravity load distributed on a one foot section of the center of the hydraulic cylinder.

(B) When surcharge loads are present from equipment weighing in excess of 20,000 pounds.

(C) When only the lower portion or a trench is shored and the remaining portion of the trench is sloped or benched unless: The sloped portion is sloped at an angle less steep than three horizontal to one vertical; or the members are selected from the tables for use at a depth which is determined from the top of the overall trench, and not from the toe of the sloped portion.

(e) *Use of Tables D–1.1, D–1.2, D–1.3 and D–1.4.* The members of the shoring system that are to be selected using this information are the hydraulic cylinders, and either the vertical shores or the horizontal wales. When a waler system is used the vertical timber sheeting to be used is also selected from these tables. The Tables D–1.1 and D–1.2 for vertical shores are used in Type A and B soils that do not require sheeting. Type B soils that may require sheeting, and Type C soils that always require sheeting are found in the horizontal wale Tables D–1.3 and D–1.4. The soil type must first be determined in accordance with the soil classification system described in appendix A to subpart P of part 1926. Using the appropriate table, the selection of the size and spacing of the members is made. The selection is based on the depth and width of the trench where the members are to be installed. In these tables the vertical spacing is held constant at four feet on center. The tables show the maximum horizontal spacing of cylinders allowed for each size of wale in the waler system tables, and in the vertical shore tables, the hydraulic cylinder horizontal spacing is the same as the vertical shore spacing.

(f) *Example to Illustrate the Use of the Tables:*

(1) Example 1:

A trench dug in Type A soil is 6 feet deep and 3 feet wide. From Table D–1.1: Find vertical shores and 2 inch diameter cylinders spaced 8 feet on center (o.c.) horizontally and 4 feet on center (o.c.) vertically. (See Figures 1 & 3 for typical installations.)

(2) Example 2:

A trench is dug in Type B soil that does not require sheeting, 13 feet deep and 5 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinders spaced 6.5 feet o.c. horizontally and 4 feet o.c. vertically. (See Figures 1 & 3 for typical installations.)

(3) A trench is dug in Type B soil that does not require sheeting, but does experience some minor raveling of the trench face. The trench is 16 feet deep and 9 feet wide. From Table D–1.2: Find vertical shores and 2 inch diameter cylinder (with special oversleeves as designated by footnote #2) spaced 5.5 feet o.c. horizontally and 4 feet o.c. vertically, plywood (per footnote (g)(7) to the D–1 Table) should be used behind the shores. (See Figures 2 & 3 for typical installations.)

(4) Example 4: A trench is dug in previously disturbed Type B soil, with characteristics of a Type C soil, and will require sheeting. The trench is 18 feet deep and 12 feet wide. 8 foot horizontal spacing between cylinders is desired for working space. From Table D–1.3: Find horizontal wale with a section modulus of 14.0 spaced at 4 feet o.c. vertically and 3 inch diameter cylinder spaced at 9 feet maximum o.c. horizontally. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(5) Example 5: A trench is dug in Type C soil, 9 feet deep and 4 feet wide. Horizontal cylinder spacing in excess of 6 feet is desired for working space. From Table D–1.4: Find horizontal wale with a section modulus of 7.0 and 2 inch diameter cylinders spaced at 6.5 feet o.c. horizontally. Or, find horizontal wale with a 14.0 section modulus and 3 inch diameter cylinder spaced at 10 feet o.c. horizontally. Both wales are spaced 4 feet o.c. vertically. 3×12 timber sheeting is required at close spacing vertically. (See Figure 4 for typical installation.)

(g) *Footnotes, and general notes, for Tables D–1.1, D–1.2, D–1.3, and D–1.4.*

(1) For applications other than those listed in the tables, refer to § 1926.652(c)(2) for use of manufacturer's tabulated data. For trench depths in excess of 20 feet, refer to § 1926.652(c)(2) and § 1926.652(c)(3).

(2) 2 inch diameter cylinders, at this width, shall have structural steel tube (3.5×3.5×0.1875) oversleeves, or structural oversleeves of manufacturer's specification, extending the full, collapsed length.

(3) Hydraulic cylinders capacities. (i) 2 inch cylinders shall be a minimum 2-inch inside diameter with a safe working capacity of not less than 18,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(ii) 3-inch cylinders shall be a minimum 3-inch inside diameter with a safe work capacity of not less than 30,000 pounds axial compressive load at maximum extension. Maximum extension is to include full range of cylinder extensions as recommended by product manufacturer.

(4) All spacing indicated is measured center to center.

(5) Vertical shoring rails shall have a minimum section modulus of 0.40 inch.

(6) When vertical shores are used, there must be a minimum of three shores spaced equally, horizontally, in a group.

(7) Plywood shall be 1.125 in. thick softwood or 0.75 inch. thick, 14 ply, arctic white birch (Finland form). Please note that plywood is not intended as a structural member, but only for prevention of local raveling (sloughing of the trench face) between shores.

(8) See appendix C for timber specifications.

(9) Wales are calculated for simple span conditions.

(10) See appendix D, item (d), for basis and limitations of the data.

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ALUMINUM HYDRAULIC SHORING
TYPICAL INSTALLATIONS

FIGURE NO. 1
VERTICAL ALUMINUM HYDRAULIC SHORING (SPOT BRACING)

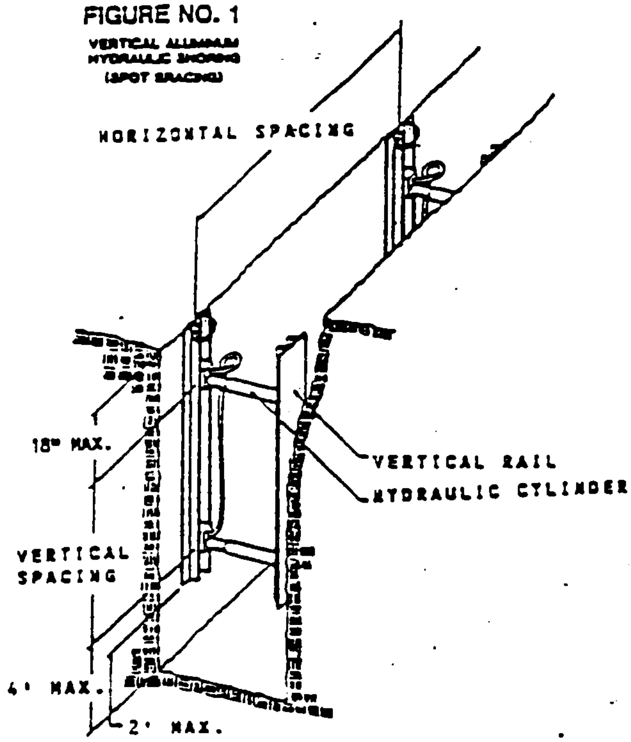

FIGURE NO. 2
VERTICAL ALUMINUM HYDRAULIC SHORING (WITH PLYWOOD)

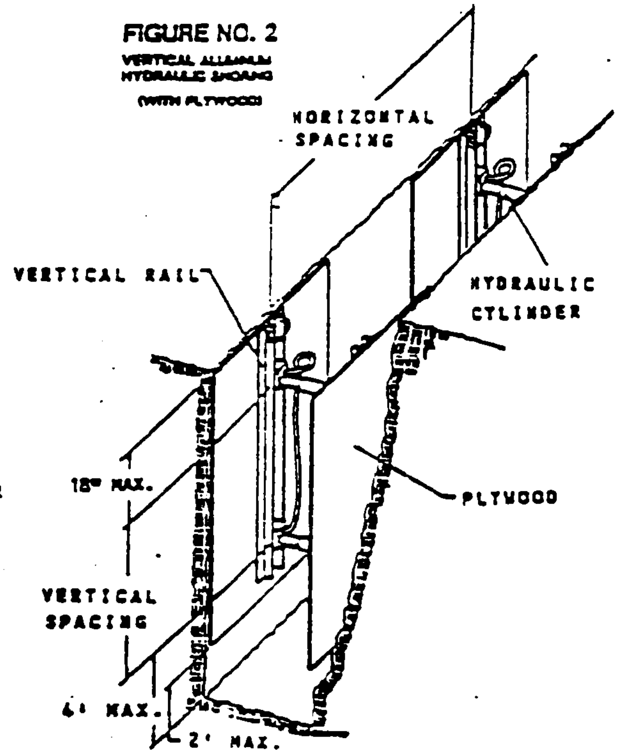

FIGURE NO. 3
VERTICAL ALUMINUM HYDRAULIC SHORING (STACKED)

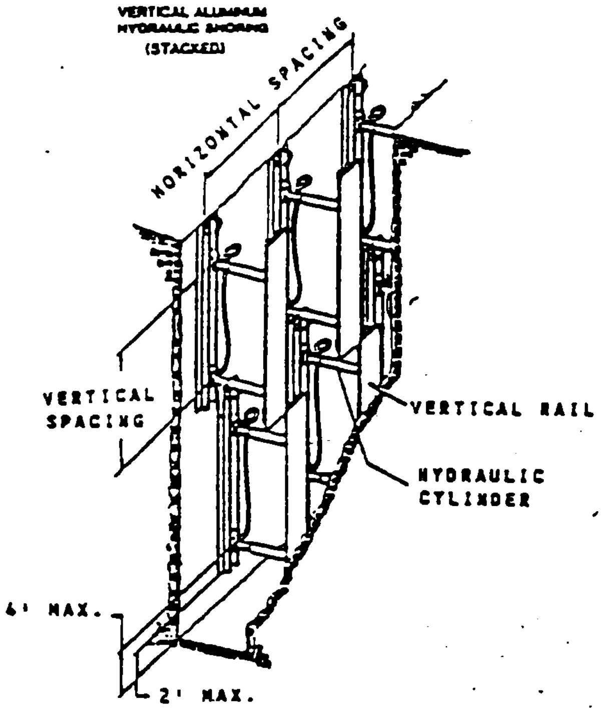

FIGURE NO. 4
ALUMINUM HYDRAULIC SHORING WALER SYSTEM (TYPICAL)

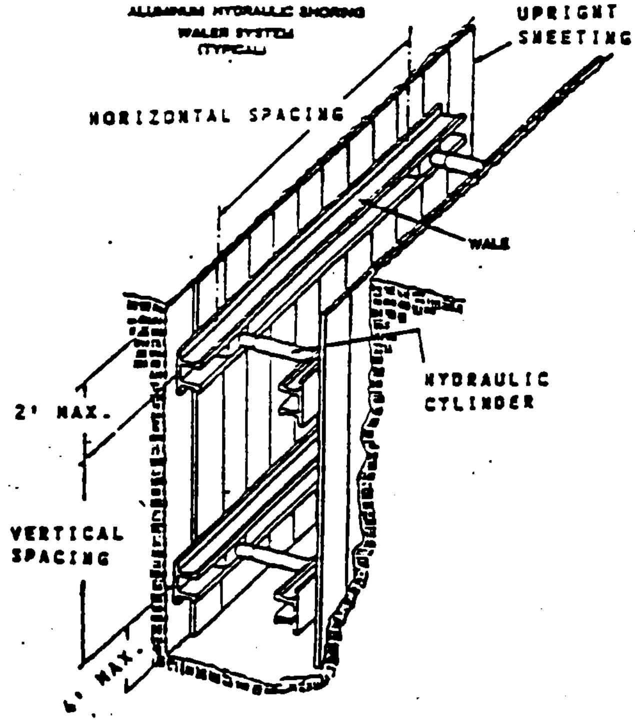

TABLE D - 1.1
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE A

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8				
OVER 10 UP TO 15	8	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 15 UP TO 20	7				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.2
ALUMINUM HYDRAULIC SHORING
VERTICAL SHORES
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	HYDRAULIC CYLINDERS				
	MAXIMUM HORIZONTAL SPACING (FEET)	MAXIMUM VERTICAL SPACING (FEET)	WIDTH OF TRENCH (FEET)		
			UP TO 8	OVER 8 UP TO 12	OVER 12 UP TO 15
OVER 5 UP TO 10	8				
OVER 10 UP TO 15	6.5	4	2 INCH DIAMETER	2 INCH DIAMETER NOTE (2)	3 INCH DIAMETER
OVER 15 UP TO 20	5.5				
OVER 20	NOTE (1)				

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Note (1): See Appendix D, Item (g) (1)
Note (2): See Appendix D, Item (g) (2)

TABLE D - 1.3
ALUMINUM HYDRAULIC SHORING
WALER SYSTEMS
FOR SOIL TYPE B

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX.HORIZ.SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN^3)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	8.0	2 IN	8.0	2 IN NOTE(2)	8.0	3 IN	—	—	3x12
		7.0	9.0	2 IN	9.0	2 IN NOTE(2)	9.0	3 IN			
		14.0	12.0	3 IN	12.0	3 IN	12.0	3 IN			
OVER 10 UP TO 15	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	—	3x12	—
		7.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 15 UP TO 20	4	3.5	5.5	2 IN	5.5	2 IN NOTE(2)	5.5	3 IN	3x12	—	—
		7.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
		14.0	9.0	3 IN	9.0	3 IN	9.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)
Notes (1): See Appendix D, item (g) (1)
Notes (2): See Appendix D, Item (g) (2)
* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

TABLE D - 1.4
ALUMINUM HYDRAULIC SHORING WALER SYSTEMS FOR SOIL TYPE C

DEPTH OF TRENCH (FEET)	WALES		HYDRAULIC CYLINDERS						TIMBER UPRIGHTS		
			WIDTH OF TRENCH (FEET)						MAX HORIZ SPACING (ON CENTER)		
	VERTICAL SPACING (FEET)	SECTION MODULUS* (IN³)	UP TO 8		OVER 8 UP TO 12		OVER 12 UP TO 15		SOLID SHEET	2 FT.	3 FT.
			HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER	HORIZ. SPACING	CYLINDER DIAMETER			
OVER 5 UP TO 10	4	3.5	6.0	2 IN	6.0	2 IN NOTE(2)	6.0	3 IN	3x12	—	—
		7.0	6.5	2 IN	6.5	2 IN NOTE(2)	6.5	3 IN			
		14.0	10.0	3 IN	10.0	3 IN	10.0	3 IN			
OVER 10 UP TO 15	4	3.5	4.0	2 IN	4.0	2 IN NOTE(2)	4.0	3 IN	3x12	—	—
		7.0	5.5	3 IN	5.5	3 IN	5.5	3 IN			
		14.0	8.0	3 IN	8.0	3 IN	8.0	3 IN			
OVER 15 UP TO 20	4	3.5	3.5	2 IN	3.5	2 IN NOTE(2)	3.5	3 IN	3x12	—	—
		7.0	5.0	3 IN	5.0	3 IN	5.0	3 IN			
		14.0	6.0	3 IN	6.0	3 IN	6.0	3 IN			
OVER 20	NOTE (1)										

Footnotes to tables, and general notes on hydraulic shoring, are found in Appendix D, Item (g)

Notes (1): See Appendix D, item (g) (1)

Notes (2): See Appendix D, Item (g) (2)

* Consult product manufacturer and/or qualified engineer for Section Modulus of available wales.

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Appendix E to Subpart P—Alternatives to Timber Shoring

Figure 1. Aluminum Hydraulic Shoring

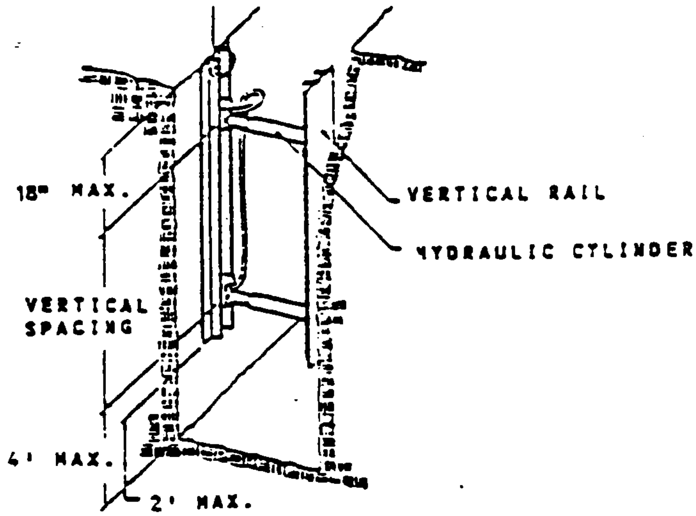

Figure 2. Pneumatic/hydraulic Shoring

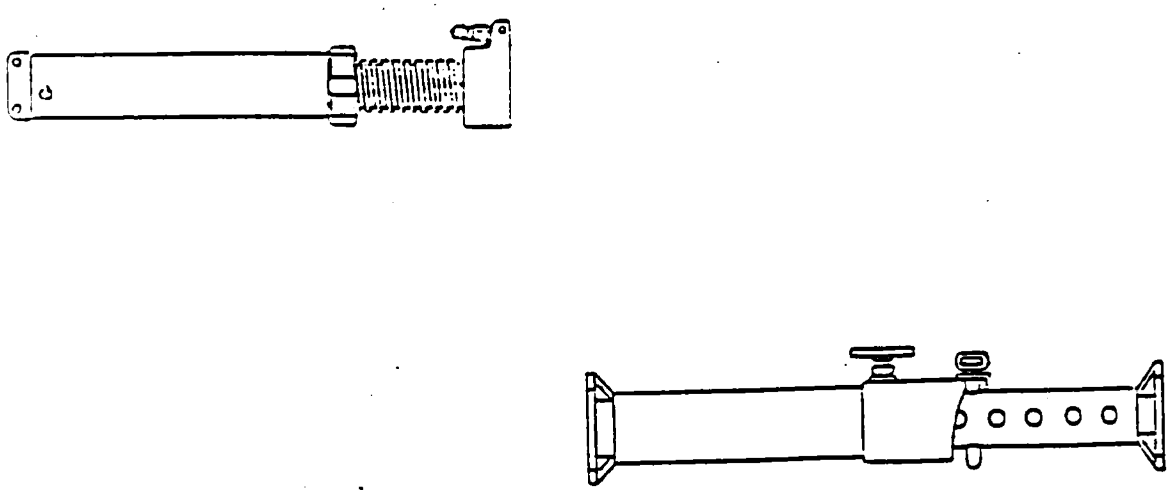

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Figure 3. Trench Jacks (Screw Jacks)

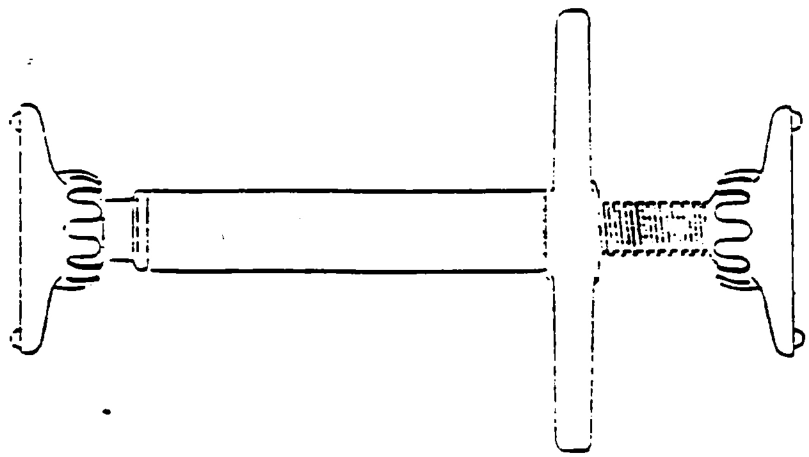
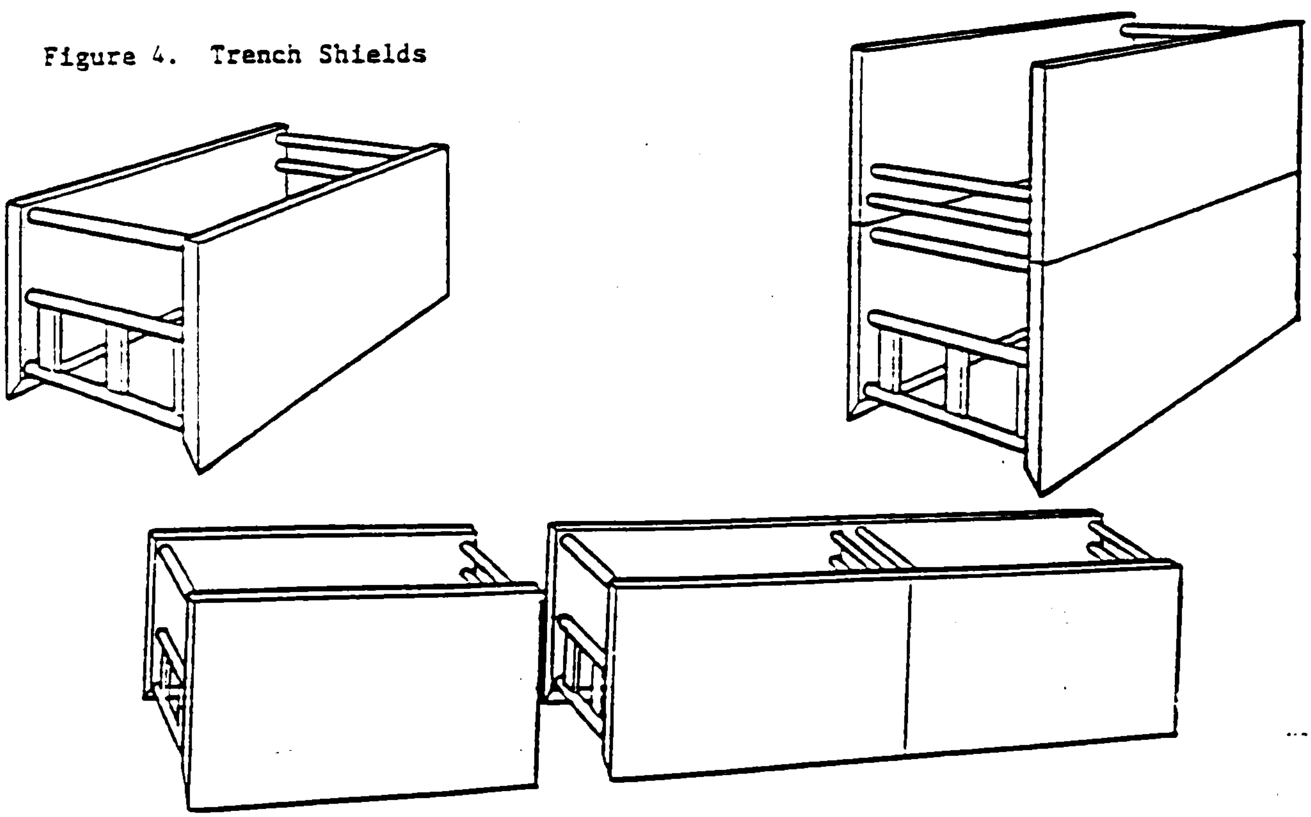


Figure 4. Trench Shields



Appendix F to Subpart P—Selection of Protective Systems

The following figures are a graphic summary of the requirements contained in subpart P for excavations 20 feet or less in depth. Protective systems for use in excavations more than 20 feet in depth must be designed by a registered professional engineer in accordance with § 1926.652 (b) and (c).

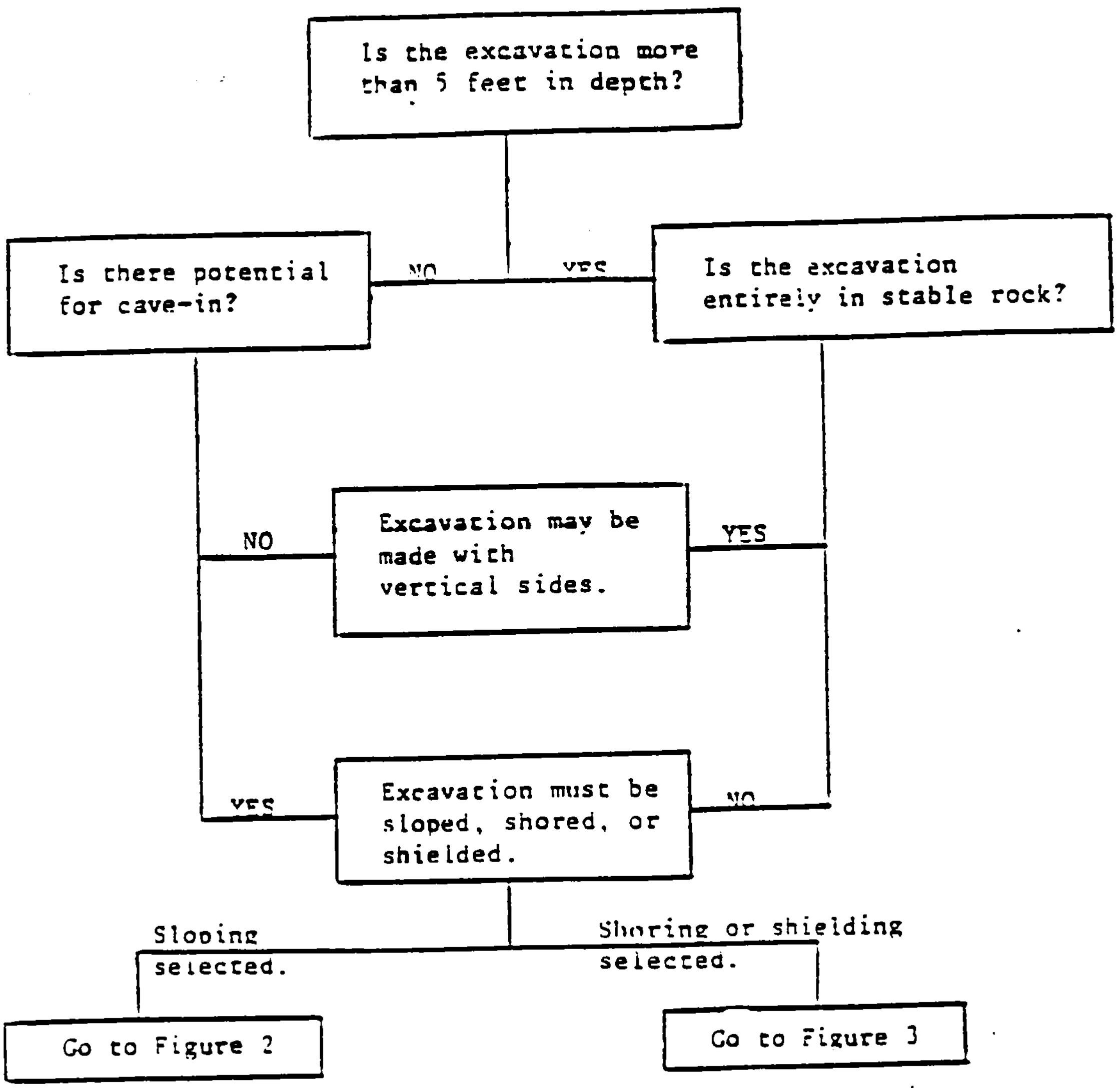


FIGURE 1 - PRELIMINARY DECISIONS

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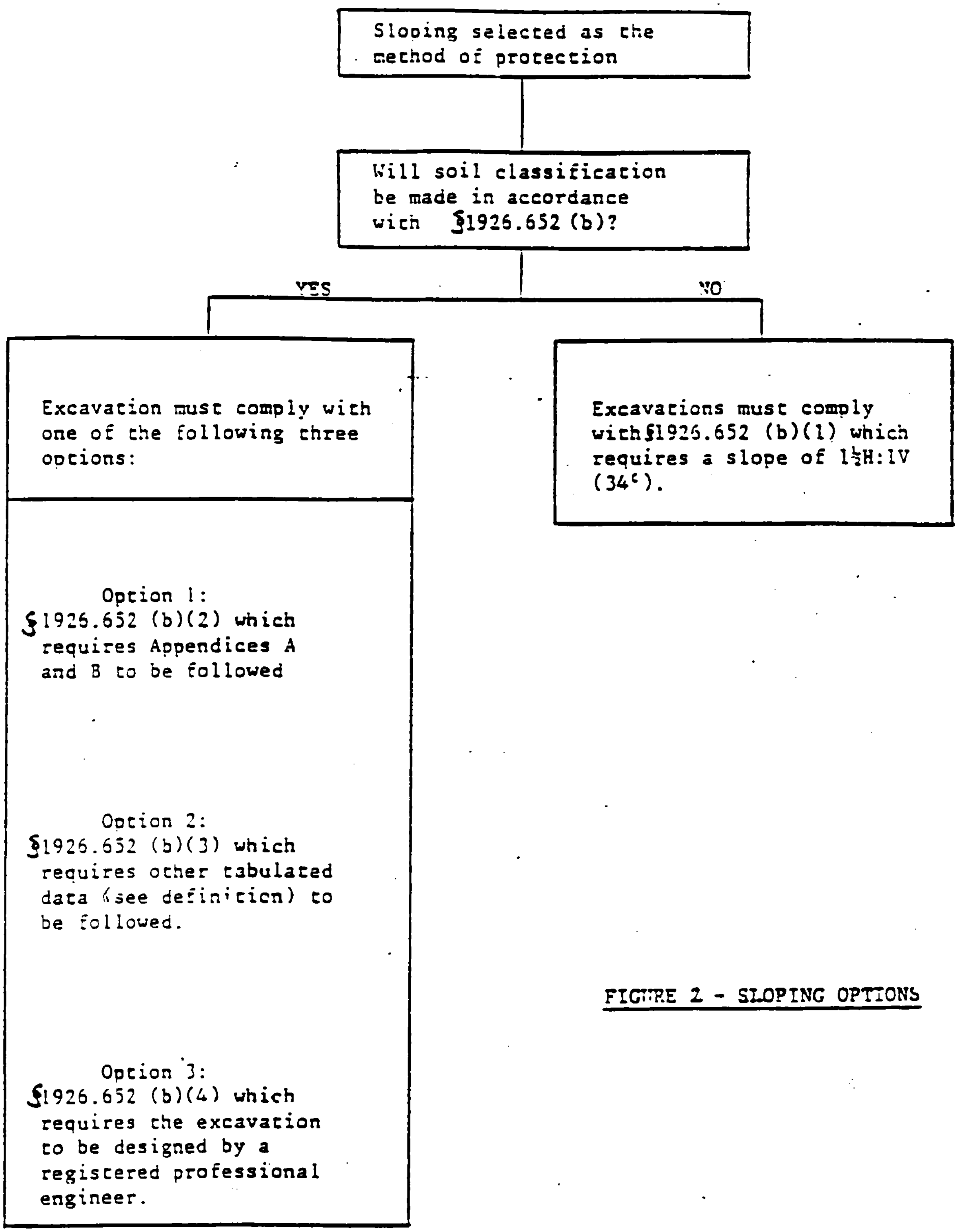


FIGURE 2 - SLOPING OPTIONS

Shoring or shielding selected as the method of protection.

Soil classification is required when shoring or shielding is used. The excavation must comply with one of the following four options:

Option 1
§1926.652 (c)(1) which requires Appendices A and C to be followed (e.g. timber shoring).

Option 2
§1926.652 (c)(2) which requires manufacturers data to be followed (e.g. hydraulic shoring, trench jacks, air shores, shields).

Option 3
§1926.652 (c)(3) which requires tabulated data (see definition) to be followed (e.g. any system as per the tabulated data).

Option 4
§1926.652 (c)(4) which requires the excavation to be designed by a registered professional engineer (e.g. any designed system).

FIGURE 3 - SHORING AND SHIELDING OPTIONS

[FR Doc. 89-25217 Filed 10-30-89; 8:45 am]
BILLING CODE 4510-26-C

K TEMPERATURE EXTREMES

K.1 HEAT STRESS

Due to the increase in ambient air temperatures and the effects of protective outer wear decreasing body ventilation, there is increased potential for injury, specifically heat casualties. Site personnel will be instructed in the identification of a heat stress victim, the first-aid treatment procedures for the victim, and the prevention of heat stress casualties.

K.1.1 Identification and Treatment

K.1.1.1 Heat Exhaustion.

Symptoms. Heat exhaustion usually begins with muscular weakness, dizziness, nausea, and a staggering gait. Vomiting is frequent. The bowels may move involuntarily. The victim is very pale, the skin is clammy, and he or she may perspire profusely. The pulse is weak and fast; breathing is shallow. The victim may faint unless he or she lies down. This may pass; however, sometimes it persists and, while heat exhaustion is generally not considered life threatening, death could occur.

First Aid. Immediately remove the victim to the CRZ in a shady or cool area with good air circulation. Remove all protective outer wear. Call a physician. Treat the victim for shock (i.e., have the victim lie down, raise the feet 6 to 12 inches, and maintain body temperature but loosen all clothing). If the victim is conscious, it may be helpful to give sips of water. Transport the victim to a medical facility.

K.1.1.2 Heat Stroke.

Symptoms. This is the most serious of heat casualties because the body excessively overheats. Body temperatures often are between 107 and 110°F. The victim will have a red face and will not be sweating. First there is often pain in the head, dizziness, nausea, oppression, and dryness of the skin and mouth. Unconsciousness follows quickly and death is imminent if exposure continues. The attack will usually occur suddenly. Heat stroke is always serious.

First Aid. Immediately evacuate the victim to a cool and shady area in the CRZ. Remove all protective outer wear and all personal clothing. Lay the victim on his or her back with the head and shoulders slightly elevated. It is imperative that the body temperature be lowered immediately. This can be accomplished by applying cold wet towels or ice bags to the head and groin. Sponge off the bare skin with cool water or rubbing alcohol, if available, or even place the victim in a tub of cool water. The main objective is to cool without chilling. Do not give stimulants. Transport the victim to a medical facility as soon as possible.

K.1.2 Prevention of Heat Stress

One of the major causes of heat casualties is the depletion of body fluids and salts through sweating. Fluids should be maintained in the Support Zone. Salts can be replaced by either a 0.1 percent salt solution, more heavily salted foods, or commercial mixes such as Gatorade. The commercial mixes are advised for personnel on low-sodium diets.

During warm weather, a work schedule will be established that allows most work to be conducted during the morning hours, before ambient air temperature levels reach highs.

A work/rest schedule will be implemented for personnel required to wear Level B or C protection (i.e., an impervious outer garment) with sufficient time allowed for personnel to "cool down" (this may require working in shifts). Two hours is the maximum time between breaks at Level B or C, regardless of temperature. At elevated temperatures, breaks should be scheduled as follows:

Ambient Temperatures	Maximum Time Between Cool Down Breaks
Above 90 °F	¼ hour
85 ° to 90 °F	½ hour
80 ° to 85 °F	1 hour
70 ° to 80 °F	1½ hours

APPENDIX K TEMPERATURE EXTREMES

K.1.3 Heat Stress Monitoring

Monitoring of personnel wearing impervious clothing should commence when the ambient temperature reaches 70 °F, with increased frequency if ambient temperature increases or as slow recovery rates are indicated. When temperatures exceed 85 °F, workers should be monitored for heat stress after every work period. As a screening mechanism of the body's recuperative ability to excess heat, one or more of the following techniques should be used.

1. Measure the heart rate (HR) for 30 seconds, by radial pulse, as early in the resting period as possible. At the beginning of the rest period, the HR should not exceed 110 beats per minute. If the HR is higher, the next work period should be shortened by 10 minutes (or 33 percent), with the length of the rest period staying the same. If the pulse rate is still above 110 beats per minute at the beginning of the next rest period, the following work cycle should again be shortened by 33 percent.

2. Measure oral body temperature with a clinical thermometer, as early as possible in the resting period. At the beginning of the rest period, oral temperature (OT) should not exceed 99 °F. If OT exceeds 99 °F, the next work period should be shortened by 10 minutes (or 33 percent), with the length of the rest period staying the same. If the OT again exceeds 99 °F at the beginning of the next period, the following work cycle should be further shortened by 33 percent. OT should also be measured at the end of the rest period to ensure that it has dropped below 99 °F.

3. Maintain good hygienic standards by changing clothes frequently, showering daily, and allowing clothing to dry during rest periods. Persons who notice skin problems should immediately consult medical personnel.

K.2 COLD STRESS

Cold weather may often cause problems for personnel working outside, even at temperatures above freezing. As temperatures drop below freezing, the potential for cold weather injuries increases dramatically, as does the potential for equipment failure. Because of the considerable danger to personnel, outdoor work should be suspended if the ambient temperature drops below 0 °F (-18 °C) or if the windchill factor drops below -29 °F (-34 °C). These levels represent guidelines that should be used as an action level unless the HSO determines and documents otherwise. Table K-1, which shows equivalent temperatures (i.e., windchill) for a range of ambient conditions, should also be referred to.Snow and ice increase the risks to personnel and operations through reduced visibility, increased potential for falling injuries, reduced on-site mobility, and the increased time required to access the site (or off-site support services).

In view of these factors, it is critical that the HSO establish site-specific safety and operating protocols, and that all on-site personnel be made aware of the risks.

K.2.1 Local Cold Injuries

Local cold injuries affect specific areas of the body (e.g., fingers, ears, or toes), including the more commonly recognized injuries described in the following subsections.

K.2.1.1 Chilblains. Chilblains is a chronic condition affecting the skin and peripheral capillary circulation, resulting from prolonged exposure of the bare skin, primarily in the extremities, to temperatures at or below 60 °F. The best method of preventing and treating chilblains is to cover and protect the skin, thereby avoiding prolonged exposure to the cold.

K.2.1.2 Frostbite. Frostbite is freezing of the hands, feet, ears, and exposed parts of the face as a result of exposure to very low temperatures. Frostbite occurs when ice crystals form in the fluid in cells of the skin and tissue. As long as blood circulation remains good, frostbite will not occur.

There are three stages of frostbite: incipient frost bite (frostnip), superficial frostbite, and deep frostbite. The classification depends on severity and can range from incipient frostbite (frostnip), which affects the skin; to superficial frostbite, which involves the skin and the tissues immediately beneath it; to deep frostbite, which is much more serious with damage that may affect deeper tissue and even bone.

Symptoms. Symptoms for each of the three stages of frostbite are described as follows.

COOLING POWER OF WIND ON EXPOSED FLESH

Estimated Wind Speed (in mph)	Actual Temperature Reading (°F)											
	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
	Equivalent Chill Temperature (°F)											
Calm	50	40	30	20	10	0	−10	−20	−30	−40	−50	−60
5	48	37	27	16	6	−5	−15	−26	−36	−47	−57	−68
10	40	28	16	4	−9	−24	−33	−46	−58	−70	**−83**	**−95**
15	36	22	9	−5	−18	−32	−45	−58	−72	**−85**	**−99**	**−112**
20	32	18	4	−10	−25	−39	−53	−67	**−82**	**−96**	**−110**	**−121**
25	30	16	0	−15	−29	−44	−59	**−74**	**−88**	**−104**	**−118**	**−133**
30	28	13	−2	−18	−33	−48	−63	**−79**	**−94**	**−109**	**−125**	**−140**
35	27	11	−4	−20	−35	−51	−67	**−82**	**−98**	**−113**	**−129**	**−145**
40	26	10	−6	−21	−37	−53	−69	**−85**	**−100**	**−116**	**−132**	**−148**

(Wind speeds of greater than 40 mph have little additional effect.)

LITTLE DANGER
In less than hr with dry skin. Greatest danger is a false sense of security.

INCREASING DANGER
Danger from freezing of exposed flesh within one minute.

GREAT DANGER
Flesh may freeze within 30 seconds

Trench foot and immersion foot may occur at any point on this chart

Source: Developed by U.S. Army Research Institute of Environmental Medicine, Natick, Massachusetts.

N:\wp51docs\Lotus\HASP−1G.wk1

- Frostnip. Skin first turns red and then later becomes pale or waxy white. There may be tingling, stinging, aching, an uncomfortable sensation of coldness or numbness, or no noticeable symptoms.

- Superficial Frostbite. The skin turns white or gray-white and is waxy in appearance. It is firm to touch (i.e., does not move easily) and the tissue beneath the skin is soft and resilient. There is a lack of sensation in the area.

- Deep Frostbite. The tissue is pale, cold, and solid with possible blisters and swelling. The hands and feet are especially susceptible to deep frostbite.

Emergency Treatment of Frostbite. Frostnip is easily treated in the field by the application of body heat, which should be applied before the affected area becomes numb. If frostnip affects your fingers and hands, place them against the skin of your chest or in your armpits. To warm your face, hold a mitten or scarf over the lower part of your face and breathe into it. Thaw frozen spots immediately. Do not rub affected areas.

Superficial frostbite usually responds to the application of body heat, as described previously. If the skin does not respond to body heat or if it resembles the early stages of deep frostbite, follow the emergency treatments listed in the following paragraphs. DO NOT rub affected areas.

For deep frostbite, if possible, the injured person should be taken to a heated shelter to avoid further frostbite. If it can be done without the danger of further frostbite, remove all constricting items (e.g., boots, gloves, and socks) from the injured area. RAPID REWARMING WILL MINIMIZE TISSUE LOSS. If possible, warm the extremities in a carefully controlled water bath (104 to 106°F) until tips of the fingers or toes turn pink and feeling is restored. If a water bath is not available, either apply wet packs (100 to 112°F) to the person's body, or gently wrap frostbitten area in blankets or some other warm material.

DO NOT attempt to thaw the affected parts by exercising them or heating them in front of an open fire, heat lamp, radiator, or stove. The person could receive a heat injury as a result of sensation loss.

DO NOT use snow to thaw frostbite. DO NOT rub, massage, or use pressure on the affected areas. Keep the frostbitten parts elevated if possible. Watch to see if CPR is necessary. Give the victim warm drinks such as tea, coffee, or soup. DO NOT GIVE ALCOHOLIC BEVERAGES. Have the victim exercise fingers or toes as soon as possible, but only after they are warmed. DO NOT allow a person with frostbitten feet to walk; walking may cause additional damage.

Medical Treatment of Frostbite.

- Frostnip. Usually does not require medical care.
- Superficial Frostbite. Blisters may require medical care.
- Deep Frostbite. EARLY MEDICAL TREATMENT IS URGENT! Transport the victim to medical care facilities at once.

Prevention of Frostbite. It is far easier to prevent or stop frostbite in earlier stages than to thaw and take care of badly frozen flesh. To protect the body against frostbite, the following precautions should be taken:

- Wear enough clothing to protect against the cold and wind.
- Wear warm gloves and boots.
- Pull a scarf or jacket flap over the lower part of the face or pull a hood tightly around the face.
- Occasionally exercise the face, fingers, and toes to keep them warm and to detect any areas that may have become numb.
- Crew members should watch each other closely, especially the face, for signs of frostbite.

K2.1.3 Immersion Foot. Immersion foot (formerly called trenchfoot) is a cold injury resulting from prolonged exposure to near-freezing temperatures when standing or walking on wet or swampy ground.

Symptoms. In the early stages, the feet and toes are pale, cold, numb, and stiff, and walking is difficult. If preventive action is not taken, the feet will swell and ache; in extreme cases, this may result in irreversible damage to the tissues of the foot or leg.

Emergency Treatment of Immersion Foot. Handle feet very gently. DO NOT rub or massage. If necessary, clean feet carefully with soap and warm water, then dry, elevate, and expose to warm but not hot air.

Prevention of Immersion Foot. Because the early stages of immersion foot are not painful, crew members must be constantly on the alert and check feet often when working in cold, wet conditions. Keep feet dry by wearing waterproof footgear and changing socks frequently because perspiration, trapped inside waterproof boots or heavy footgear, can contribute to immersion foot symptoms. Avoid standing in wet areas. If feet get wet, dry them as soon as possible, warm them with your hands, then use foot powder, and change to dry socks. If you cannot change wet boots and socks, exercise your feet frequently by wriggling your toes and moving your ankles. Never wear tight boots.

K.2.2 Systemic Cold Injuries

Systemic injuries are those that affect the entire body system. Severe body cooling, known as systemic hypothermia, can occur at temperatures well above freezing. Hypothermia, which can be fatal, is the progressive lowering of body temperature accompanied by rapid, progressive mental and physical collapse. A large percentage of wilderness deaths are the result of hypothermia.

Hypothermia is caused by exposure to cold, and is aggravated by moisture, cold winds, fatigue, hunger, inadequate clothing or shelter, and excessive perspiration from strenuous exercise followed by too rapid cooling.

Hypothermia often occurs between temperatures of 30 to 50 °F, which most people believe are not dangerous. Crew members should be alert for symptoms of hypothermia, especially when temperatures are dropping rapidly or when they must work in rain, snow, or ice.

Hypothermia may occur on land or following submersion in even moderately cold water (i.e., 65 °F or lower). On land, hypothermia may take a full day or more of exposure to develop; however, if the conditions are extremely severe, death may occur within a few hours of initial symptoms.

In cold water, death may seem to be from drowning; in reality, it is usually the result of hypothermia. In water, skin and nearby tissues chill very fast; in 10 to 15 minutes, the temperature of the heart and brain may drop. When the core (i.e., internal body) temperature reaches 90 °F, unconsciousness may occur; when body temperature drops to 80 °F, heart failure is possible.

K.2.2.1 Symptoms. In the early stages of hypothermia, the body begins to lose heat faster than it can be produced, making an effort to stay warm by shivering. When the body can no longer generate enough heat to overcome heat loss and the energy reserves of the body become exhausted, body temperature begins to drop. This affects the ability of the brain to make judgments and also results in loss of muscular control. As the body temperature drops, hypothermia symptoms become increasingly severe, as shown in the following table:

SYMPTOMS OF HYPOTHERMIA	APPROXIMATE CORE TEMPERATURE
Person is conscious, alert with increased respiration. Shivering may become uncontrollable as core temperature nears 95 °F.	Above 95 °
Person is conscious but disoriented and apathetic. Shivering is present but diminishes as temperature drops. Below 92 °F, respiratory rate gradually diminishes and pupils being to dilate.	95 ° to 90 °F
Person is semiconscious. Shivering is replaced by muscular rigidity. Pupils are fully dilated at about 86 °F.	90 ° to 86 °F
Unconscious: diminished respiration.	Below 86 °F
Barely detectable or nondetectable respiration.	Below 80 °F

K.2.2.2 Emergency Treatment of Hypothermia. Move hypothermia victim to shelter and warmth as rapidly as possible. In very mild cases, dry clothing and shelter may be all that is needed. Gently remove all of the victim's wet clothing (so energy is not expended by warming and drying wet clothing) and replace it with a dry set. Give the person something warm to drink. DO NOT GIVE ALCOHOLIC BEVERAGES.

ALL OTHER HYPOTHERMIA CASES SHOULD BE CONSIDERED MEDICAL EMERGENCIES. PROVIDE EXTERNAL HEAT IN ANY WAY POSSIBLE! A warm bath (with the water kept between 105° and 110°F) is the most effective way of warming a victim of hypothermia. NEVER put an UNCONSCIOUS VICTIM in a bathtub.

If it is not possible to give the person a warm bath, use one of the following ALTERNATE METHODS :

- Wrap warm moist towels (or other fabric) around the victim's head, neck, sides, and groin. As the packs cool, rewarm them by adding warm water (approximately 105°F). Check the temperature of the water with your elbow or the inside of your arm; it should be warm but not hot.

- If you are at a remote outdoor location and cannot use the other method, make a "human sandwich" by placing the unclothed victim in a sleeping bag (or between blankets) with two other undressed persons to provide body-to-body heat transfer. THIS WILL SAVE LIVES. Additional sleeping bags or blankets can be placed over and under the victim.

DO NOT wrap a hypothermia victim in a blanket without an auxiliary source of heat unless it is to protect against any further heat loss before treatment can begin, or you need to go for help and there is no other alternative.

Continue treatment once the victim has stabilized. Give warm liquids and nourishing food if the person is conscious. Check the person for symptoms of frostbite and if necessary, give treatment.

Handle the patient gently and do not allow him or her to walk. Exertion can circulate cold stagnant blood from extremities to the central body and cause "after-drop," in which the patient's core temperature drops below the level that will sustain life. ALCOHOL CONTRIBUTES TO AFTER-DROP.

K.2.2.3 Medical Care for Hypothermia. HYPOTHERMIA IS A SEVERE EMERGENCY. GET MEDICAL TREATMENT AS SOON AS POSSIBLE. Even persons with mild hypothermia should see a doctor.

K.2.2.4 Prevention of Hypothermia. In cold weather, never go into the field without wearing adequate clothing. Take a complete change of warm clothes and one or two extra pairs of socks (in plastic bags). Wear or carry a windproof, water-resistant outer jacket and, in rain or snow, wear adequate raingear.

Stay dry. If your clothing becomes wet from perspiration, rain, snow, or immersion in water, change it as soon as possible. If you start to shiver in a prolonged or violent way, seek shelter at once. Shivering may produce heat but it also uses up energy. Violent shivering may be an early sign of hypothermia.

Avoid accidental immersion in water. Practice boat safety and learn cold water survival techniques. If you fall into water and you are not very close to shore, remain quiet. Keep your head out of water, climb onto the boat, or hold or climb onto any other object that will support you and keep you up out of the water.

K.2.3 Safety/First Aid Equipment

In view of the causes, results, and appropriate treatment of cold weather injuries discussed previously, as a minimum, the following safety equipment should be included during cold weather operations:

- extra clothing for all personnel
- blankets and/or sleeping bag
- high-energy food and drinking water supply
- toboggan
- tow ropes

In extreme cold conditions, add the following safety items:

- electric blanket (if an electrical source is available)
- portable emergency generator (with fuel, oil, and cords)

- space heater and fuel

K.2.4 General Winter Operations

Cold weather conditions can severely affect winter operations. The Site Manager and HSO must plan work schedules and project tasks accordingly.

K.2.4.1 Preliminary Assessment. If you will be working outdoors in cold weather, assess the local weather conditions through the news media (i.e., radio, television, and newspapers) to determine whether work should progress and/or the amount of preparation needed. Carefully consider questions such as the following:

- What are the typical wind and weather conditions for the period in which you will be working?
- Are the areas in which you will work sheltered or open to the wind?
- Is there a place nearby for periodic warming breaks? Can you obtain or heat warm food and beverages there? Is there a source of drinking water?
- Are there ways to minimize the length of time that crew members will have to work outdoors in the cold?
- If you use a vehicle for a warming area or will use a heater in a closed room, how can you ensure there is adequate ventilation to prevent carbon monoxide poisoning?

K.2.4.2 Scheduling. Wherever possible, try to schedule work during the least severe weather. Rotate crew members to keep cold exposures short and allow sufficient time for frequent warming breaks. Remember that workers in heavy clothing often need more time to complete the tasks and may become fatigued more easily. Be aware that operations may have to be discontinued if winds increase or the temperature drops.

Because winter days are short, scheduling should allow time for taking care of equipment and supplies before nightfall. Once it becomes dark, it is more difficult to gauge terrain, and temperatures are likely to drop.

K.2.4.3 Site Access. Snow and ice could make travel on site access roads impossible, or treacherous at best. Personnel should not be allowed to work on-site if conditions could severely hamper the arrival or departure of emergency vehicles. If the route to off-site medical facilities is blocked by snow or ice, an otherwise minor injury could result in a major medical emergency. If conditions warrant, the following provisions should be made:

- snow removal/plowing services for site access roads
- a dependable, four-wheel-drive vehicle available to on-site personnel for transporting an injured person to an off-site medical facility
- sleeping bags, blankets, a food supply, and water kept on-site in the event a sudden storm requires personnel to remain overnight

The HSO is responsible for deciding when weather conditions make site access unsafe, thereby requiring work to stop until conditions improve.

K.2.4.4 Equipment and Supplies. Obtain equipment and supplies that will help prevent cold stress and will help in the treatment of cold stress disorders. Required equipment includes a reliable ambient temperature thermometer, a wind gauge, and a windchill chart. If the site is potentially windy due to a lack of natural or manmade windbreaks (e.g., trees, valleys, and structures), try to provide means of shielding workers from the wind. If working at a remote location, carry extra food and water because hunger and dehydration contribute to cold stress. If possible, make provisions for hot food and beverages. Ensure that emergency communication equipment is available and operational for crew members working in the cold, at heights, or in remote locations.

Close attention must be given to the effects of cold weather on field equipment. Batteries can be severely affected by cold resulting in disabled radios, air monitoring equipment, sampling pumps, and vehicles. A supply of fresh batteries, a sufficient number of charging units, and a set of automotive jumper cables should be maintained on-site. In addition, the electronics in many field instruments such as PI, LEL, and oxygen meters, as well as the chemical reactions in detector tubes (e.g., Draeger tubes) can also be adversely affected by the cold. The manufacturers' literature must be consulted for minimum operating temperatures.

If at all possible, monitoring well sampling tasks should not be scheduled during cold weather. These tasks generally require the use of relatively delicate pumps; long, uninsulated stretches of tubing; and significant quantities of decontamination solutions. Unless considerable effort is expended to prevent pumps, hoses, decontamination solutions, and sample containers from freezing, attempting to sample monitoring wells in cold weather may be counter- productive. Portable shelters should be considered if cold weather sampling is necessary.

APPENDIX L DECONTAMINATION

L DECONTAMINATION

L.1 PERSONNEL DECONTAMINATION

Decontamination procedures are followed by all personnel leaving hazardous waste sites. Under no circumstances (except emergency evacuation) will personnel be allowed to leave the exclusion and contaminant reduction zones prior to decontamination. A typical personnel decontamination station is shown in Figure L-1. Generalized procedures for removal of protective clothing are as follows:

1. Drop tools, monitors, samples, and trash at designated drop stations (i.e., plastic containers or drop sheets).

2. Step into the designated shuffle pit area and scuff feet to remove gross amounts of dirt from outer boots.

3. Scrub outer boots and outer gloves with decon solution or detergent and water. Rinse with water.

4. Remove tape from outer boots and remove boots; discard tape and boots in disposal container.

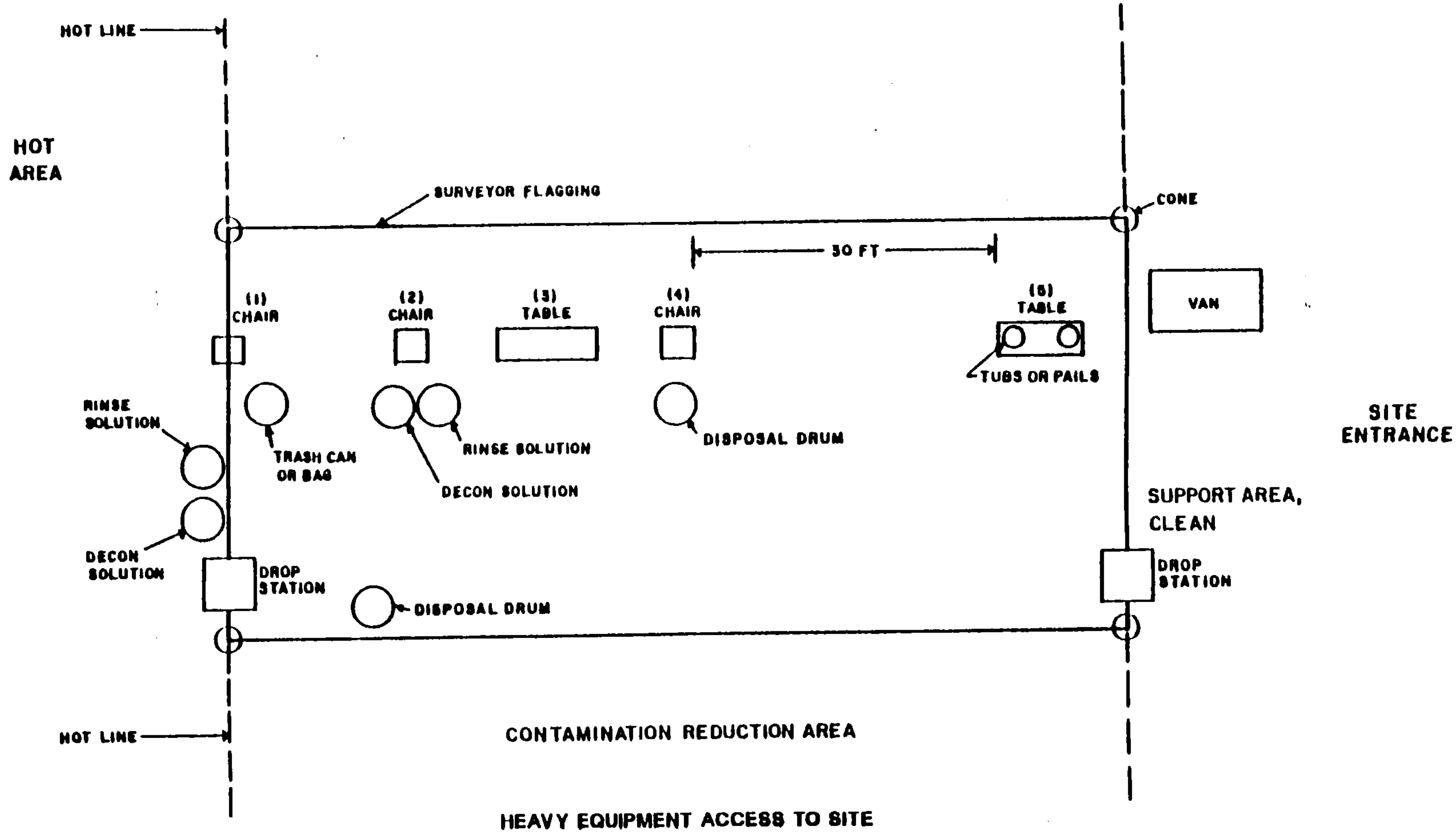
5. Remove tape from outer gloves and remove gloves; discard tape and gloves in disposal container.

6. If the worker has left the Exclusion Zone to change the air tank on the SCBA or the canister on the air-purifying respirator, this will be the last step in the decontamination procedure. The tank or cartridge should be exchanged, new outer gloves and boot covers donned, and the joints taped; the worker then returns to duty.

7. Remove outer garments and discard in disposal container.

8. Remove respirator and place or hang in the designated area.

9. Remove inner gloves and discard in disposal container.



TASK

(1) WASH OUTER BOOTS - RINSE BOOTS - DISPOSE
(2) WASH OUTER GLOVES - RINSE GLOVES - DISPOSE
(3) SCBA TANK CHANGE OVER TABLE W/SPARE TANKS
(4) REMOVE OUTER GARMENT - DISPOSE
(5) REMOVE SCBA, WASH MASK IN PAILS OR TUBS
(6) REMOVE INNER GLOVES - DISPOSE

NOT TO SCALE

FIGURE L-1
TYPICAL PERSONNEL DECONTAMINATION STATION

10. If the site requires use of a decontamination trailer, all personnel must shower before leaving the site at the end of the work day.

NOTE: Disposable items (i.e., Tyvek coveralls, inner gloves, and latex overboots) will be changed daily unless there is reason to change sooner. Dual respirator canisters will be changed daily, unless more frequent changes are deemed appropriate by site surveillance data or personnel assessment.

Maximum and minimum decontamination layouts for PPE Levels A through C are shown in Figures L-2 through L-6.

Pressurized sprayers or other designated equipment will be available in the decontamination area for washdown and cleaning of personnel, samples, and equipment.

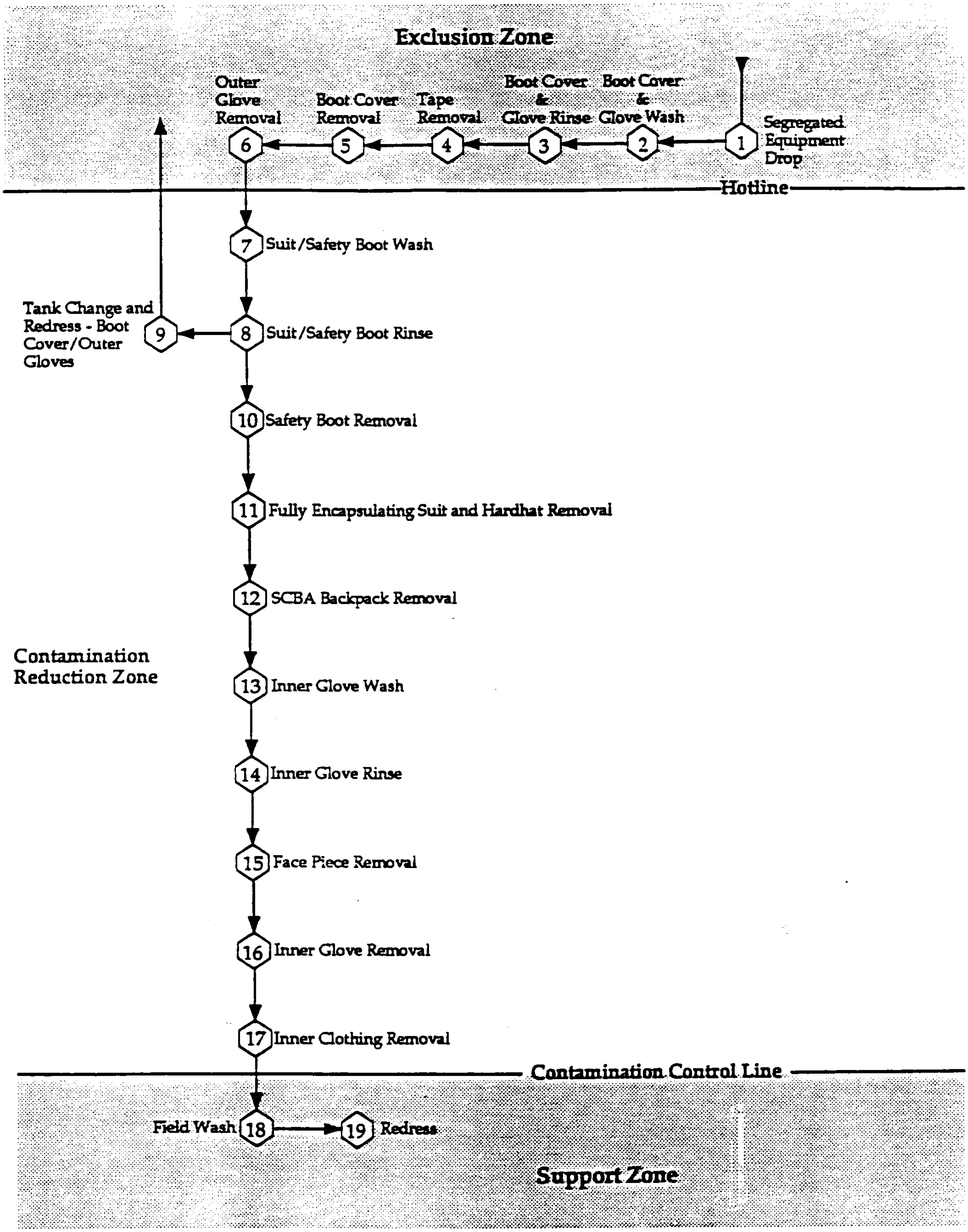
Respirators will be decontaminated daily and taken from the drop area. The masks will be disassembled, the cartridges set aside, and all other parts placed in a cleansing solution. Parts will be pre-coded (e.g., # 1 on all parts of Mask # 1). After an appropriate time in the solution, the parts will be removed and rinsed with tap water. Old cartridges will be marked to indicate length of use (i.e., if it is possible to evaluate the remaining utility of the cartridge), or discarded in the contaminated trash container for disposal. In the morning, the masks will be reassembled and new cartridges installed, if appropriate. Personnel will inspect their own masks and readjust the straps for proper fit.

L.2 Small Equipment Decontamination

Small equipment will be protected from contamination as much as possible by draping, masking, or otherwise covering the instruments with plastic (to the extent feasible), without hindering operation of the unit. For example, the PI meter can be placed in a clear plastic bag to allow for reading the scale and operating the knobs. The PI meter can be partially wrapped, keeping the sensor tip and discharge port clear.

The contaminated equipment will be taken from the drop area and the protective coverings will be removed and disposed of in appropriate containers. Any dirt or

Figure L-2
Maximum Decontamination Layout
Level A Protection



1870-04D

Figure L-3
Maximum Decontamination Layout
Level B Protection

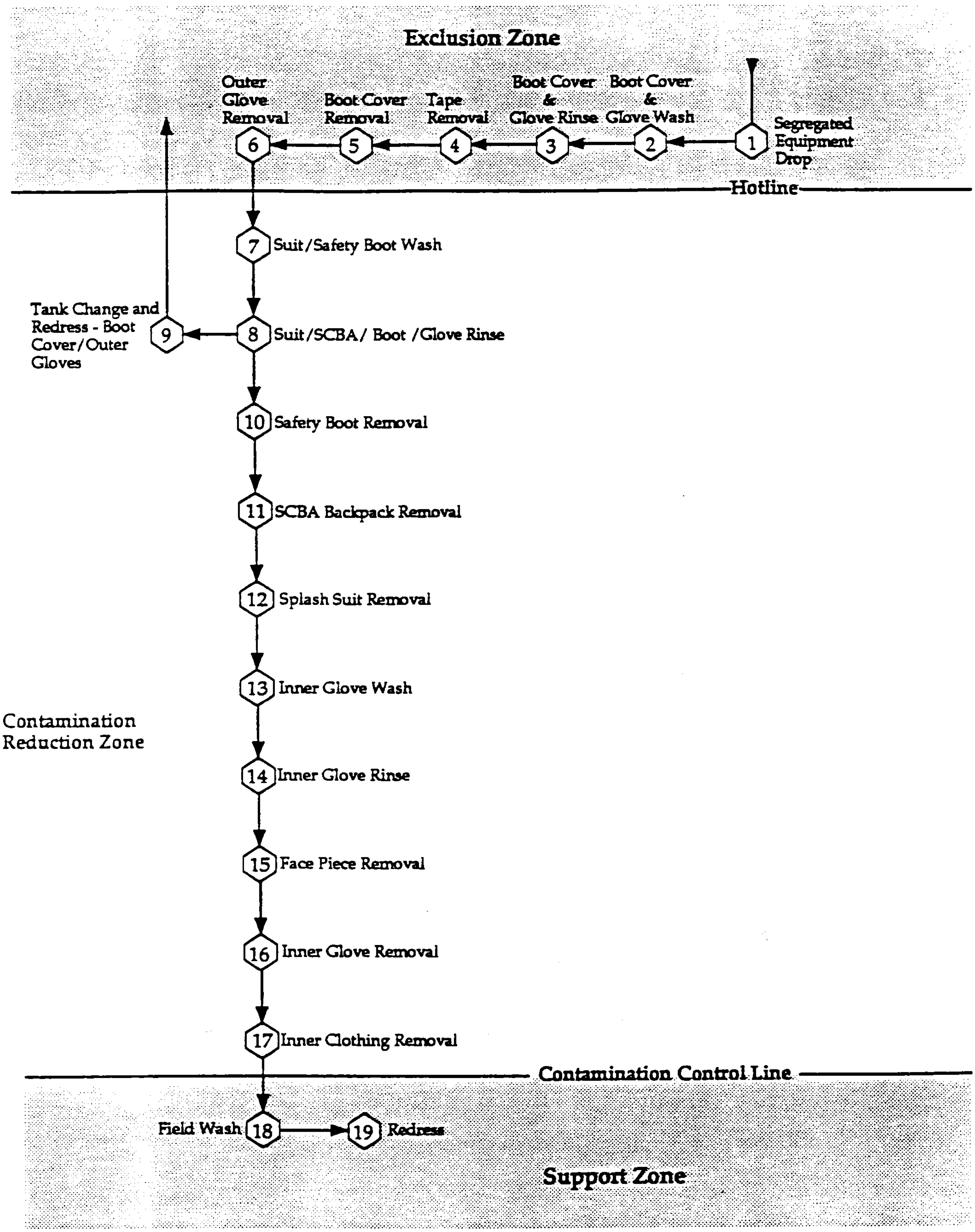


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Figure L-4
Maximum Decontamination Layout
Level C Protection

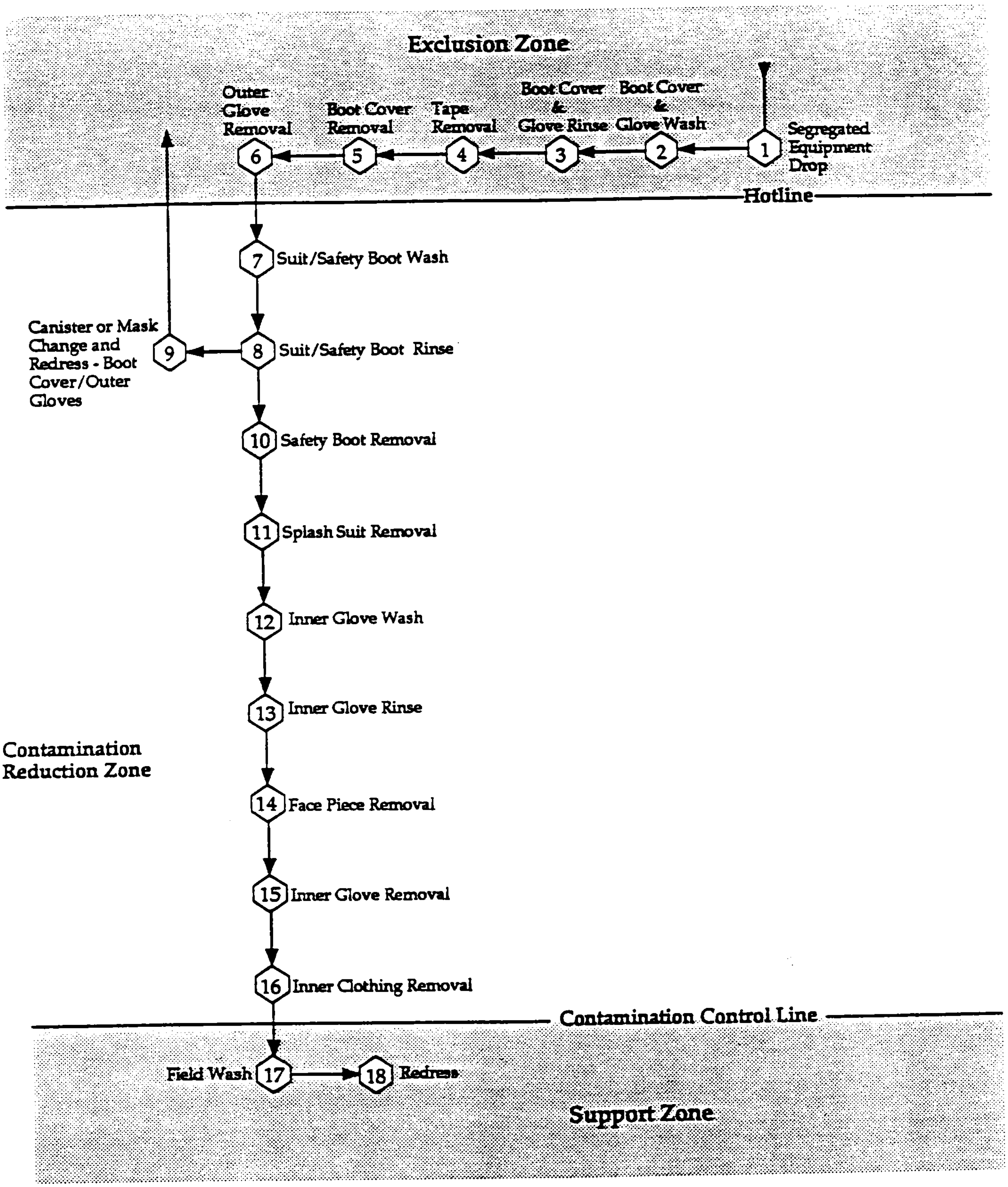

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Figure L-5
Minimum Decontamination Layout
Levels A and B Protection

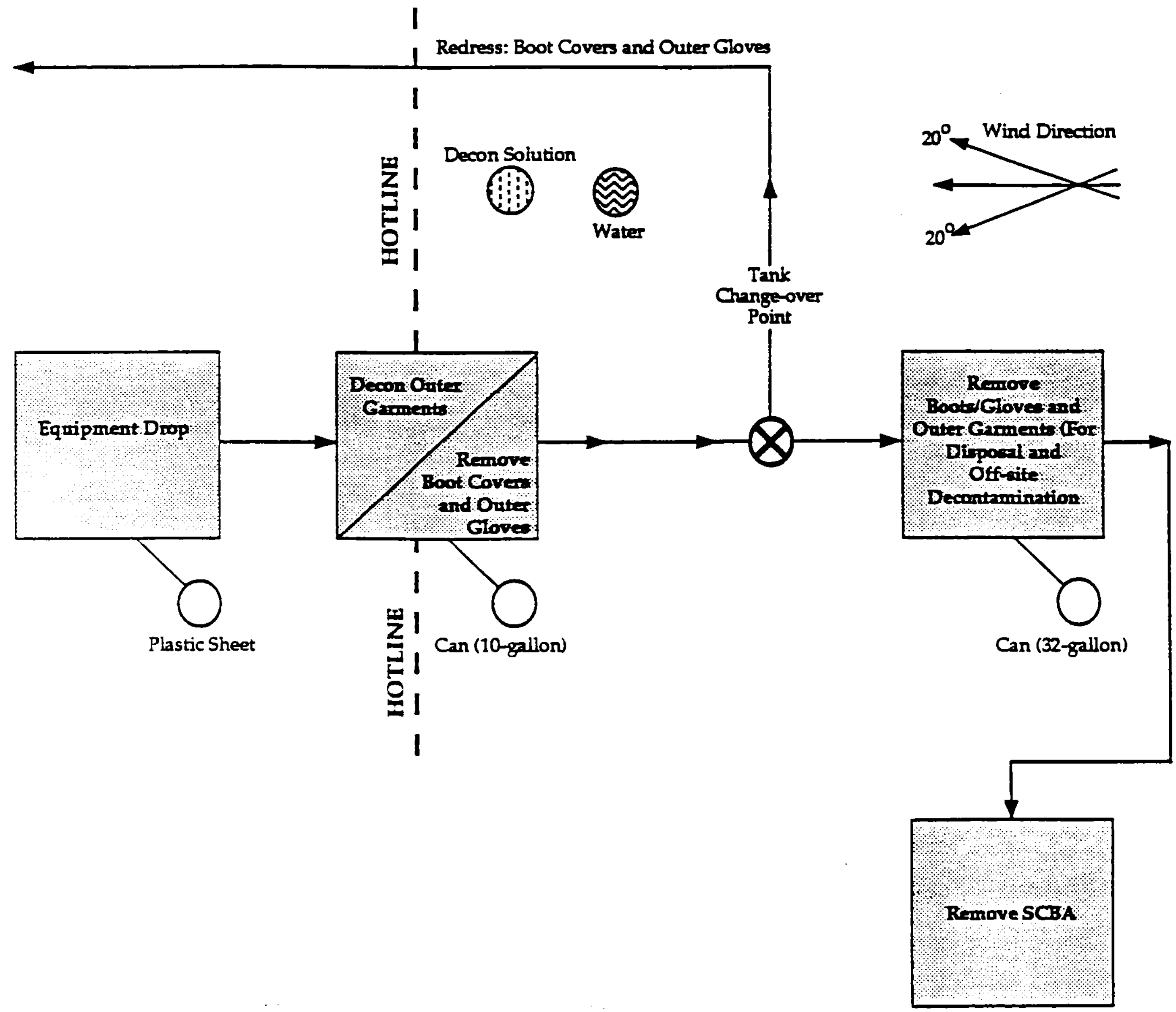
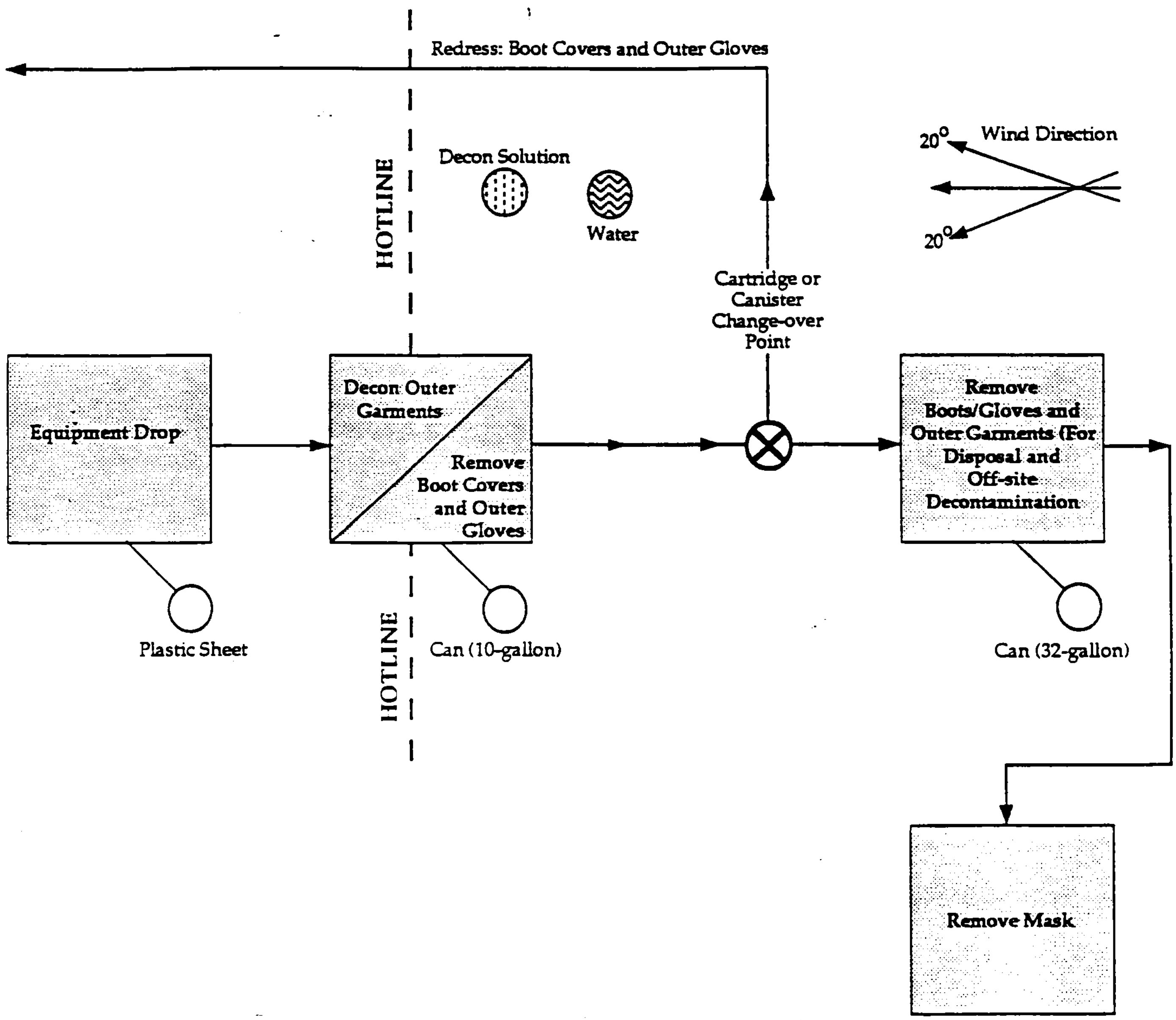


Figure L-6
Minimum Decontamination Layout
Level C Protection



obvious contamination will be brushed or wiped with a disposable paper wipe. The units can then be taken inside in a clean plastic tub, wiped off with damp disposable wipes, and dried. The units will be checked, standardized, and recharged as necessary for the next day's operation, and then prepared with new protective coverings.

L.3 Heavy Equipment Decontamination

It is anticipated that drilling rigs and backhoes will become contaminated during borehole and test-pitting activities. They will be cleaned with high-pressure water or steam, followed by a soap and water wash and rinse. Loose material will be removed with a brush. The person performing this activity will usually be at least at the level of protection used during the personnel and monitoring equipment decontamination.

L.4 Disposal Of Decontaminated Materials

All protective gear, decontamination fluids (for both personnel and equipment), and other disposable materials will be disposed of at each site.

Decontamination fluids identified to be contaminated by site contaminants (i.e., Liqui-nox, used to decontaminate sampling equipment such as split spoons and groundwater sampling pumps) will be stored in DOT-approved 55-gallon drums. Contaminated disposable materials (e.g., gloves and Tyveks) will be double-bagged and stored as is, or placed in DOT-approved 55-gallon drums.

APPENDIX M EMERGENCY PLANNING

M EMERGENCY PLANNING

M.1 EMERGENCY MEDICAL SERVICES

Prior to site investigation or activity on hazardous sites, nearby health facilities will be evaluated to determine their ability to provide for the needs of on-site project staff. Criteria such as emergency department physician coverage, decontamination capabilities, and available medical specialists will be evaluated.

M.1.1 On-site First Aid

An industrial first-aid kit will be provided at the work site; contents of the kit will be checked weekly and restocked as necessary. Other equipment may include oxygen, backboard and straps, splints, and a cervical collar.

At least one person qualified to perform first aid will be present on-site at all times during work activity. This person will have earned a certificate in first-aid training from the American Red Cross or will have received equivalent training. Designated first aides will receive regular review training from the American Red Cross or the equivalent.

An eye-wash station will be provided at the work site, as well as flushing water for decontamination of boots, gloves, clothing, and tools.

M.1.2 Transportation to Emergency Treatment

A vehicle will be available at all times to transport personnel to the hospital (in the event an ambulance is unnecessary or unavailable). Stretchers will be located at the work site to transport personnel to the vehicle. Under no circumstances will injured persons transport themselves to a medical facility for emergency treatment.

M.2 CONTINGENCY PLANNING

Prior to commencement of on-site activities, the HSO will review safety considerations with the field crew. The HSO has overall responsibility for adherence to the designated safety precautions and assumes the role of on-site coordinator in an emergency response situation.

All on-site personnel will be familiarized with both the primary and secondary route to the nearest hospital (which may be shown on a figure or a local map), as well as the location of the nearest working telephone or radio communication device. A list of emergency telephone numbers will be posted in the trailer.

The local hospital and emergency response team will be advised in advance of the work to be performed. The hospital will also be briefed on the availability of personnel health data and technical support through Environmental Medicine Resources, Inc.

Emergency communication will be required to ensure positive preplanned notification of emergency authorities in the event of episodes requiring initiation of contingency plans. Emergency communication will include all or parts of the following:

- Coordinate with local agencies, fire and police departments, the ambulance service. and the hospital emergency room.

- Establish two-way radio communication and a site alarm capable of warning site personnel and summoning assistance (i.e., airhorn).

- Design an emergency evacuation plan for residents of nearby homes. Although evacuation is an unlikely event, as a contingency, the HSO will be designated as on-site coordinator and will be responsible for implementing the plan. The HSO will be made aware of the total number of households within a 2,000-foot radius. The Health and Safety Plan will provide the emergency contacts required and a table will provide a list of residences and identifiable operations in the area in the event that evacuation is deemed a possibility for a particular site.

- Investigate possible routes of evacuation prior to any activity.

- If an accident occurs, a copy of an accident report form, provided in Appendix N, should be filled out by the HSO and filed with the individual's supervisor, the HSM or HSS, and Human Resources. A copy should also be retained in the project records.

M.3 POTENTIAL HAZARDS

The most common hazards associated with hazardous waste site investigation include (1) accidents; (2) inhalation, contact, or ingestion of hazardous materials; (3) explosion; and (4) fire.

M.3.1 Accidents

Accidents must be handled on a case-by-case basis. Minor cuts, bruises, muscle pulls, and the like will still allow the injured person to undergo reasonably normal decontamination procedures before receiving direct first aid. More serious injuries may not permit complete decontamination procedures to be undertaken, particularly if the nature of the injury is such that the victim should not be moved. In these cases, arrangements will be made with the medical facility and transporter to allow them to take proper precautions. The nature and degree of surface contamination at a site is generally low enough that emergency vehicles could reach the victim on-site without undue hazard. However, if on-site access is limited, accident victims may be transported by ABB Environmental personnel trained for this response to a point accessible by an ambulance.

M.3.2 Contact and/or Ingestion of Hazardous Materials

Properly prescribed and maintained protective clothing and adherence to established safety procedures are designed to minimize this hazard. However, it is still possible that contact or ingestion of materials may occur. For example, puncture of a buried drum of liquid during drilling operations might cause the drum contents to contact personnel. Standard first-aid procedures should be followed. The drilling rig will have a tank of water that may be useful in some circumstances, particularly to flush contaminants from any exposed skin areas. Eye-wash bottles will also be maintained at the site for emergencies. In cases of ingestion or anything other than minor contact with known substances, the local Poison Control Center and hospital should be notified and the victim taken there immediately for further treatment and observation.

M.3.3 Explosion

The drilling crew should be keenly aware of combustible gas meter readings and should withdraw at any indication of imminently hazardous conditions (i.e., greater than 20 percent LEL). The detection of such conditions will be reported to local agencies for potential execution of the evacuation plan, if the situation is assessed to warrant such response.

M.3.4 Fire

The combustible gas meter also warns of imminent fire hazards at borings. The greatest fire hazard at the site should be recognized as handling the fluids (e.g., methanol and acetone) used for certain decontamination procedures. No smoking or open flames are allowed on-site. Carbon dioxide fire extinguishers will be kept at the drilling rig and in the decontamination area/field office. The fire department, previously informed of site activities, will be called as needed.

M.4 EVACUATION RESPONSE LEVELS

Evacuation responses will occur at three levels: (1) withdrawal from immediate work area (100 feet or more upwind), (2) site evacuation, and (3) evacuation of surrounding area. Anticipated conditions that require these responses are described in the following subsections.

M.4.1 Withdrawal Upwind (100 Feet or More)

Withdrawing upwind (100 feet or more) will be required when (1) ambient air conditions contain greater contaminant concentrations than guidelines allow for the type of respiratory protection being worn (the work crew may return after donning greater respiratory protection and/or assessing the situation as transient and past); (2) a breach in protective clothing or minor accident occurs (the work crew may return when the tear or other malfunction is repaired and first aid or decontamination has been administered); or (3) the respirator malfunctions requiring replacement.

M.4.2 Site Evacuation

Evacuation of the site will be required when (1) ambient air conditions contain explosive and persistent levels of combustible gas or excessive levels of toxic gases; (2) a fire or major accident occurs; or (3) explosion is imminent or has occurred.

M.4.3 Surrounding Area Evacuation

The area surrounding the site will be evacuated when persistent, unsuppressable toxic or explosive vapors from test pits or borings (e.g., pressure release from punctured drum) are released, or air quality monitored at several points downwind assess danger to the surrounding area.

M.5 EVACUATION PROCEDURES

M.5.1 Withdrawal Upwind

The work crew will continually observe general wind directions while on-site. (A simple wind sock may be set up near the work site for visual determinations.) Upon observing conditions that warrant moving away from the work site, the crew will relocate upwind a distance of approximately 100 feet or farther, as indicated by the site monitoring instruments. Donning SCBA and a safety harness and line, the HSO and a member of the crew may return to the work site to determine whether the conditions noted were transient or persistent. If persistent, an alarm should be raised to notify on-site personnel of the situation and the need to leave the site or don SCBA. An attempt should be made to decrease emissions only if greater respiratory protection is donned. The HSM, HSS, and client will be notified of conditions. When access to the site is restricted and escape is thereby hindered, the crew may be instructed to evacuate the site rather than move upwind, especially if withdrawal upwind moves the crew away from escape routes.

M.5.2 Site Evacuation

After determining that site evacuation is warranted, the work crew will proceed upwind of the work site and notify the security force, HSO, and field office of site conditions. If the decontamination area is upwind and more than 500 feet from the work site, the crew will pass quickly through decontamination to remove contaminated outer suits. If the hazard is toxic gas, respirators will be retained. The crew will proceed to the field office to assess the situation, where the respirators may be removed (if instrumentation indicates an acceptable condition). As more facts are determined from the field crew, they will be relayed to the appropriate agencies. The advisability and type of further response action will be coordinated and implemented by the HSO.

M.5.3 Evacuation of Surrounding Area

When the HSO determines that conditions warrant evacuation of downwind residences and commercial operations, the local agencies will be notified and assistance requested. Designated on-site personnel will initiate evacuation of the immediate off-site area without delay.

M.6 SPILL CONTROL PLAN

When working around containers of bulk chemicals (e.g., drums or tanks), every effort should obviously be made to avoid damaging the container, which would discharge the contents and further contaminate the area. However, in the unlikely event that an accident does occur, a Spill Control Plan must be developed based on site contaminants and conditions, and the precautions that need to be taken to control and minimize the effects of the spill. Personnel must be trained and have adequate equipment to be able to contain or control a spill, plus be able to decontaminate previously uncontaminated structures, equipment, or material. In addition, spilled materials and contaminated soils and/or water must be collected, containerized, and disposed of properly.

Some equipment that may be needed in addition to personal protective equipment include: sand, "kitty litter," or some other absorbent material; sandbags; a front-end loader; DOT-approved 55-gallon drums or salvage drums; shovels; drum repair kit; chemicals to neutralize acids or bases; or decontamination equipment. The choice of equipment needed for the site is based on the amount and type of contaminants known or suspected to be at the site, as well as the work to be conducted.

M.6.1 Personal Protective Equipment

In the event of a spill or leak, the work crew must back off until adequate personal protective equipment can be donned. In most cases, Level B personal protective equipment will be required; however, there may be incidences where Level C or D is acceptable. The HSO will determine the level of protection based on the contaminant, amount spilled, and levels monitored in the air.

M.6.2 Control Measures

Once the work crew is adequately protected, immediate measures should be taken to control and contain the spill within site boundaries. The hazardous area should be isolated and all unnecessary personnel kept away and upwind of the spill. Do not allow any flares, smoking, or open flames into the area and, if possible, avoid allowing combustible materials to come in contact with the spill.

Small Spills. If the spilled material is a solid, shovel contaminated material directly into a container, then cover, label, and dispose of it properly. If the spilled material is a liquid, absorb with sand, "kitty litter," or some other noncombustible absorbent material first, then shovel it into a container, and cover, label, and dispose of it properly.

Large Spills. For large liquid spills, install a dike using sandbags, absorbent pillows, soil, or any other available, noncombustible material. Ensure that the dike is large enough to contain the spill. Pump off and containerize any standing liquid. Recycle it if possible, or solidify it with an absorbent material, then cover, label, and dispose of it properly. Collect and containerize all contaminated soil, then cover, label, and dispose of it properly. For large solid spills, collect, containerize, cover, label, and dispose of it properly.

M.6.3 Reporting

If the amount spilled is reportable under Resource Conservation and Recovery Act (RCRA) requirements and goes off-site, or if there is a threat to human health or the environment, the proper authorities must be notified. The HASP will list the agencies to be notified in the event of an emergency.

APPENDIX N HEALTH AND SAFETY FORMS AND DATA SHEETS

N HEALTH AND SAFETY FORMS AND DATA SHEETS

N.1 HEALTH AND SAFETY AUDIT

Site Name: ______________________ Date: __________

Auditor: ______________________

SEND A COPY OF COMPLETED FORM TO THE HEALTH AND SAFETY MANAGER.

GENERAL	YES	NO	COMMENTS
HASP on-site?	___	___	___
HASP completely signed off and approved?	___	___	___
OSHA poster posted in trailer?	___	___	___
Emergency telephone numbers posted in trailer?	___	___	___
Emergency eyewash on-site?	___	___	___
Emergency shower on-site?	___	___	___
Stretcher on-site?	___	___	___
First-aid kit on-site?	___	___	___
Adequately stocked?	___	___	___
Proper sanitation facilities?	___	___	___

	YES	NO	COMMENTS
DOCUMENTATION AND RECORDKEEPING			
Only personnel listed and approved in HASP on-site?	___	___	___
All personnel properly trained?	___	___	___
All personnel in health monitoring program?	___	___	___
Daily field records kept by the Site Manager?	___	___	___
Levels of PPE recorded?	___	___	___
Contaminant levels recorded?	___	___	___
Site surveillance records kept by HSO?	___	___	___
Calibration records maintained?	___	___	___
Accident/incident forms on-site?	___	___	___
Field team review sheets signed?	___	___	___
Medical data sheets completed?	___	___	___
Spare hospital directions available?	___	___	___
Visitors logbook completed?	___	___	___
MSDSs for chemicals on-site?	___	___	___
HASP revisions recorded?	___	___	___
First-aid kit inspected weekly?	___	___	___

	YES	NO	COMMENTS
Are daily safety meetings held?	___	___	______________
Emergency procedures discussed during safety meetings?	___	___	______________

EMERGENCY RESPONSES

	YES	NO	COMMENTS
Vehicle available on-site for transportation to the hospital?	___	___	______________
Fire extinguishers on-site?	___	___	______________
At least two persons trained in CPR and first-aid on-site at all times?	___	___	______________
All personnel know who is trained?	___	___	______________

PERSONNEL PROTECTIVE EQUIPMENT

	YES	NO	COMMENTS
Proper PPE being worn as specified in the HASP?	___	___	______________
Level of PPE being worn:	______________		
PPE adequate for work conditions?	___	___	______________
If not, give reason:	______________		
Upgrade/downgrade to PPE level:	______________		
Has facial hair that would interfere with fit of respirators been removed?	___	___	______________
If not, willing to shave if necessary?	___	___	______________
Fit-tested within the last year?	___	___	______________

	YES	NO	COMMENTS
If Level B, back-up/emergency person suited up (except for air)?	___	___	___
HSO periodically inspects PPE and equipment?	___	___	___
PPE not in use properly stored?	___	___	___
MONITORING EQUIPMENT			
All equipment listed in HASP on-site?	___	___	___
Properly calibrated?	___	___	___
In good condition?	___	___	___
Used properly?	___	___	___
Other equipment needed?	___	___	___
List:	___		
Monitoring equipment covered with plastic to minimize contamination?	___	___	___
DECONTAMINATION			
Decon line set up properly?	___	___	___
Proper cleaning fluid used for known or suspected contaminants?	___	___	___
Proper decon procedures used?	___	___	___
Decon personnel wearing proper PPE?	___	___	___

	YES	NO	COMMENTS
Equipment decontaminated?	___	___	___
Samples decontaminated?	___	___	___
Disposable items changed twice a day or more often if needed?	___	___	___
WORK PRACTICES			
Proper collection and disposal of contaminated PPE?	___	___	___
Proper collection and disposal of decon fluid?	___	___	___
Water available for decon?	___	___	___
Buddy system used?	___	___	___
Equipment kept off drums and ground?	___	___	___
Kneeling or sitting on drums or ground not allowed?	___	___	___
Personnel avoid standing or walking through puddles or stained soil?	___	___	___
Zones established?	___	___	___
If night work to be conducted, adequate illumination?	___	___	___
Smoking, eating, or drinking in the Exclusion Zone or CRZ not allowed?	___	___	___

	YES	NO	COMMENTS
To the extent feasible, contaminated materials handled remotely?	___	___	___________
Contact lenses not allowed on-site?	___	___	___________
Entry into excavations not allowed unless properly shored or sloped?	___	___	___________
All unusual situations on-site listed in HASP?	___	___	___________
If not, what?	___________		
Action taken?	___________		
HASP revised?	___	___	___________

CONFINED SPACE ENTRY

	YES	NO	COMMENTS
All confined spaces identified?	___	___	___________
If not, list:	___________		
All appropriate equipment available and in good working order?	___	___	___________
Equipment properly calibrated?	___	___	___________
Confined Space Checklists used?	___	___	___________
Checklists completely and correctly filled out?	___	___	___________

ABB ENVIRONMENTAL SERVICES INC.
ACCIDENT REPORT

: INFORMATION:

Site:______________________________ Job Number:______________

Location:______________________________

Location of Accident (if different from above):______________________________

Did injury involve ABB-ES Associate?:_______ Subcontractor?:________ Other?:______________

PERSONAL INFORMATION:

Name of Injured Person:______________________________

Address of Injured Person:______________________________

Telephone number:______________ Date of Hire:___________ Date Current Duties Began:________

SSN:______________ DOB:___________ Marital Status:______________

Occupation: ______________ Department: ______________

ACCIDENT INFORMATION:

Date of Accident:______________ Time of Accident:______________

Time Injured Persons Workday Began:___________ Weather Conditions:______________

Name of Witness:______________________________ Telephone No.:______________

Address:______________________________

:cident Category:

- ☐ Chemical Exposure
- ☐ Physical Injury
- ☐ Motor Vehicle
- ☐ Fire
- ☐ Property Damage (list):______________
- ☐ Other:______________
- ☐ Estimated Amount of Property Damage:______________

Classification of Injury:

☐ Heat Burns	☐ Allergic Reaction	☐ Lacerations	☐ Fracture
☐ Chemical Burns	☐ Bites	☐ Punctures	☐ Dislocations
☐ Radiation Burns	☐ Poison Ivy	☐ Abrasions	☐ Nausea
☐ Toxic-Respiratory	☐ Heat Stroke	☐ Sprains	☐ Headache
☐ Toxic-Dermal	☐ Cold Exposure	☐ Bruises	☐ Faint/Dizzy
☐ Toxic-Ingestion	☐ Blisters	☐ Concussion	
☐ Other:______________			

If chemical exposure, list all possible contaminants of concern:______________________________

____

Part(s) of Body Affected (back, knee, head, etc.):______________________________

Date Medical Care Received:_________ Emergency Service (Y/N):_______ Follow-up Examination Needed (Y/N):__

Name and Address of Medical Facility:______________________________

____

Name of Physician:______________ Telephone Number:______________

Estimated Degree of Disability (High/Moderate/Low*): ______________ Estimated No. of days away from work?__

High, unlikely to return to work that day or within the next few days; Moderate, will return to work but won't likely be able to do full duties; ,ow, will likely be able to return to full work duties that day.

Date/Time Associate returned to work:______________ Associate on Restricted Duty?______________

Revised April 1997

CAUSE OF INJURY/ACCIDENT:

Causitive agent(s) most directly related to accident (e.g., object, substance, material, machinery, equipment, or weathe

____

____

Were there unsafe mechanical/physical/environmental condition(s) at the time of the accident?:______________

____

Did an unsafe act contribute to the accident? If yes, specify:______________

____

Did personal factors contribute to the accident (e.g., improper attitude, lack of knowledge or skill, slow reaction, fatigue, inattention, or horseplay.):______________

____

ACCIDENT PREVENTION:

Level of Personal Protective Equipment required in the HASP:______________

Was injured using required equipment?:__________. If not, how did actual equipment differ from what was required in the HASP. Describe:______________

____

Was personal protective equipment required in the HASP adequate for site conditions?__________

If no, what additional equipment was needed?:______________

____

What can be done to prevent a re-occurrence of this type of accident? (e.g., ventilation, machine modification/ guarding, modification of work practices, or additional training.):______________

____

____

NARRATIVE:

Provide a **detailed** description of how and why the accident occured. Include objects, equipment, tools, circumstances of assigned duties, weather, etc. ***Be specific!*** :______________

____

____

____

____

____

____

Signature of Preparer:______________________________ Date:______________

Signature of Site Manager:______________________________ Date:______________

SEND A COPY OF THE COMPLETED FORM TO THE MANAGER, HEALTH AND SAFETY - PORTLAND, ME.

N.3 HSO CHECKLIST FOR FIELD OPERATIONS

The following is a list of the minimum equipment and materials needed to fulfill the requirements health and safety at a site. This list does not include monitoring equipment, decontamination equipment, or personal health and safety equipment (e.g., respirators, tyveks, and boots).

Need	Posted?	Paperwork
		Health and Safety Plan
		Health and Safety Plan Appendix
		Field Team Review Sheets
		Medical Data Sheets
		OSHA Job Safety & Health Protection Poster
		Emergency Information Sheet
		Spare Hospital Directions
		Blank Accident Report Forms
		Visitors Logbook
		H & S Audit Form
		Confined Space Entry Forms
		Site-specific HASP Attachments
		MSDSs for Chemicals Taken On-site (other than those in HASP Appendix)
		1.
		2.

Need	Quantity	Equipment
		First Aid Kit
		Emergency Eye Wash Station
		Fire Extinguisher
		Emergency Horn
		Emergency Stretcher/Backboard

N.4 Material Safety Data Sheets

N.4.1 LIQUI-NOX
N.4.2 TRISODIUM PHOSPHATE
N.4.3 HYDROCHLORIC ACID
N.4.4 NITRIC ACID

ALCONOX Inc.

Quality Detergents for Laboratory, Hospital, Industry
215 PARK AVENUE ... NEW YORK ...

TO: CE Environmental
ATTN Bill Thurston
FAX: 207-773-0011

DATE: 1/19/90
PAGE 1 OF 1
FROM Malcolm

Material Safety Data Sheet
May be used to comply with OSHA's Hazard Communication Standard, 29 CFR 1910.1200. Standard must be consulted for specific requirements.

U.S. Department of Labor
Occupational Safety and Health Administration
(Non-Mandatory Form)
Form Approved
OMB No. 1218-0072

IDENTITY (As Used on Label and List): LIQUI-NOX

Note: Blank spaces are not permitted. If any item is not applicable, or no information is available, the space must be marked to indicate that.

Section I

Manufacturer's Name: ALCONOX, INC.

Address (Number, Street, City, State and ZIP Code): 215 PARK AVENUE SOUTH NEW YORK, NEW YORK 10003

Emergency Telephone Number: (212) 473-1300

Telephone Number for Information: (212) 473-1300

Date Prepared: JULY 1, 1987

Signature of Preparer (optional):

Section II — Hazardous Ingredients/Identity Information

Hazardous Components (Specific Chemical Identity; Common Name(s)) | OSHA PEL | ACGIH TLV | Other Limits Recommended | % (optional)

THERE ARE NO INGREDIENTS IN LIQUI-NOX WHICH APPEARED ON THE OSHA STANDARD 29 CFR 1910 SUBPART Z.

Section III — Physical/Chemical Characteristics

Boiling Point	$214^{O}F$	Specific Gravity (H_2O = 1)	1.075
Vapor Pressure (mm Hg.)	NO DATA	Melting Point	N.A.
Vapor Density (AIR = 1)	NO DATA	Evaporation Rate (Butyl Acetate = 1)	NO DATA

Solubility in Water: COMPLETELY SOLUBLE IN ALL PROPORTIONS

Appearance and Odor: YELLOW LIQUID - PRACTICALLY ODORLESS

Section IV — Fire and Explosion Hazard Data

Flash Point (Method Used): NONE (CLEVELAND OPEN CUP)	Flammable Limits	LEL N.A.	UEL N.A.

Extinguishing Media: WATER, DRY CHEMICAL, FOAM, CO_2, SAND/EARTH

Special Fire Fighting Procedures: FOR FIRES INVOLVING THIS MATERIAL, DO NOT ENTER WITHOUT PROTECTIVE EQUIPMENT AND SELF CONTAINED BREATHING APPARATUS.

Unusual Fire and Explosion Hazards: NONE

(Reproduce locally)

Section V — Reactivity Data

Stability	Unstable		Conditions to Avoid: NONE
	Stable	XX	

Incompatibility (Materials to Avoid): NONE

Hazardous Decomposition or Byproducts: SO_2 MAY BE RELEASED ON BURNING

Hazardous Polymerization	May Occur		Conditions to Avoid: NONE
	Will Not Occur	XX	

Section VI — Health Hazard Data

Route(s) of Entry: Inhalation? NO Skin? YES Ingestion? YES

Health Hazards (Acute and Chronic): SKIN CONTACT MAY PROVE LOCALLY IRRITATING. INGESTION MAY CAUSE DISCOMFORT AND/OR DIARRHEA.

Carcinogenicity: NTP? NO IARC Monographs? NO OSHA Regulated? NO

Signs and Symptoms of Exposure: PROLONGED SKIN CONTACT MAY CAUSE DRYING AND/OR CHAPPING.

Medical Conditions Generally Aggravated by Exposure: NONE

Emergency and First Aid Procedures: EYES-FLUSH WITH PLENTY OF WATER FOR 15 MINUTES. SKIN-FLUSH WITH WATER. INGESTION-DRINK LARGE QUANTITIES OF WATER. GET MEDICAL ATTENTION FOR DISC...

Section VII — Precautions for Safe Handling and Use

Steps to Be Taken in Case Material Is Released or Spilled: MATERIAL FOAMS PROFUSELY. RECOVER AS MUCH AS POSSIBLE WITH ABSORBENT MATERIAL AND RINSE REMAINDER TO SEWER. MATERIAL IS COMPLETELY BIODEGRADAB...

Waste Disposal Method: SMALL QUANTITIES MAY BE DISPOSED OF IN SEWER. LARGE QUANTITIES SHOULD BE SOAKED UP WITH ABSORBENT MATERIAL AND DISPOSED OF ACCORDING TO LOCAL ORDINA...

Precautions to Be Taken in Handling and Storing: NONE REQUIRED -VISCOSITY OF MATERIAL INCREASES AT VERY LOW TEMPERATURES.

Other Precautions: NO SPECIAL REQUIREMENTS OTHER THAN THE GOOD INDUSTRIAL HYGIENE AND SAFETY PRACTICES EMPLOYED WITH ANY INDUSTRIAL CHEMICAL

Section VIII — Control Measures

Respiratory Protection (Specify Type):

Ventilation	Local Exhaust: NORMAL	Special	N.A.
	Mechanical (General): N.A.	Other	N.A.

Protective Gloves: RECOMMENDED | Eye Protection: RECOMMENDED

Other Protective Clothing or Equipment: NOT REQUIRED

Work/Hygienic Practices: NO SPECIAL PRACTICES REQUIRED

N.4.1 LIQUI-NOX

Monsanto MATERIAL SAFETY DATA

NER CODE A-111

MONSANTO PRODUCT NAME
TRISODIUM PHOSPHATE CRYSTALLINE

MONSANTO COMPANY
800 N. LINDBERGH BLVD.
ST. LOUIS, MO 63167

Emergency Phone No.
(Call Collect)
314-694-1000

PRODUCT IDENTIFICATION

Synonyms:	TSP/C; Trisodium orthophosphate; Sodium phosphate, tribasic; Phosphoric acid, trisodium salt; Trisodium phosphate dodecahydrate
Chemical Formula:	$Na_3PO_4 \cdot 12H_2O \cdot 1/4\ NaOH$ (approximately)
CAS No.:	10101-89-0*
DOT Proper Shipping Name:	Sodium Phosphate, Tribasic (see NOTE below)
DOT Hazard Class/ I.D. No.:	ORM-E/NA9148
DOT Label(s):	Not Applicable
Hazardous Substance(s)/ RQ(s):	Yes/5,000 lbs.
U.S. Surface Freight Classification:	Trisodium Phosphate

Note: Bagged material is not regulated.

*Since hydrated materials could not be reported on the ~~TSCA Initial~~ Inventory List, Trisodium Phosphate Crystalline was reported as anhydrous with the CAS No. 7601-54-9.

WARNING STATEMENTS

DANGER!
CAUSES EYE BURNS
CAUSES SKIN IRRITATION

PRECAUTIONARY MEASURES

Do not get in eyes, on skin, on clothing.
Avoid breathing dust.
Keep container closed.
Use with adequate ventilation.
Wash thoroughly after handling.

EMERGENCY AND FIRST AID PROCEDURES

FIRST AID: IF IN EYES, immediately flush with plenty of water for at least 15 minutes. Call a physician.

IF ON SKIN, immediately flush with plenty of water. Remove contaminated clothing. Wash clothing before reuse.

MATERIAL SAFETY DATA

TRISODIUM PHOSPHATE CRYSTALLINE

OCCUPATIONAL CONTROL PROCEDURES

Eye Protection: Wear chemical safety goggles to prevent eye contact. Have eye baths immediatey available where eye contact can occur.

Skin Protection: Wear appropriate impervious gloves and protective clothing to prevent skin contact. Launder contaminated clothing and clean protective equipment before reuse.

Respiratory Protection: Use NIOSH approved equipment suitable for nuisance dust when airborne exposure is excessive. Consult respirator manufacturer to determine appropriate type equipment for given application.

Ventilation: Provide ventilation to minimize exposure. Local exhaust ventilation preferred.

Airborne Exposure Limits: Product: Trisodium phosphate dodecahydrate

Although no specific exposure limit has been established for this material, OSHA and ACGIH have established limits for nuisance dusts:

OSHA PEL/TWA: Total 15 mg/m^3; Respirable 5 mg/m^3
ACGIH TLV/TWA: Total 10 mg/m^3; Respirable 5 mg/m^3

Keep exposure below these limits.

FIRE PROTECTION INFORMATION

This material is not combustible.

REACTIVITY DATA

Materials to Avoid: Trisodium Phosphate Crystalline could be corrosive to aluminum surfaces because of high pH. Sealed containers should be kept free of water because of its corrosivity when wet.

Hazardous Decomposition Products: None.

Hazardous Polymerization: Does not occur..

PHYSIOLOGICAL EFFECTS SUMMARY

Oral LD_{50} (Rat): 6,500 mg/kg, Practically Nontoxic
Dermal LD_{50} (Rabbit): 7,940 mg/kg, Practically Nontoxic
Eye Irritation (Rabbit): (FHSA) Corrosive
Skin Irritation (Rabbit): (FHSA) 3.3 on a scale of 8.0, Moderately Irritating

PHYSICAL DATA

Appearance and Odor: White, crystalline, free-flowing granules or powder; odorless

pH (1% solution @ 25°C): 12.0

Bulk Density (lbs./cu. ft.): Powder 61-65
Granular 58-64

Solubility (g/100 g H_2O) (Anhydrous Salt Basis):
11.6 @ 25°C
17.5 @ 40°C
35.3 @ 60°C
61.3 @ 80°C
84.5 @ 100°C

Note: These physical data are typical values based on material tested but may vary from sample to sample. Typical values should not be construed as a guaranteed analysis of any specific lot or as specification items.

MATERIAL SAFETY DATA INDUSTRIAL CHEMICALS

SPILL, LEAK & DISPOSAL INFORMATION

Waste Disposal: Dispose of in a landfill in accordance with all local, state and federal regulations.

Spill or Leakage Procedures: Sodium phosphate, tribasic, as currently defined, is a *hazardous substance* in the Comprehensive Environmental Response, Compensation and Liability Act of 1980 (Superfund) and in the current federal regulations 40 CFR, Part 116 (Section 311, Clean Water Act) with a reportable quantity of 5,000 pounds when released to the environment. Since federal, state and local laws may vary, consult your attorney or appropriate regulatory officials for information relating to spill reporting.

Sweep, scoop or vacuum up all spilled material, contaminated soil and other contaminated material and place in containers. If possible, complete cleanup on a dry basis. After all practical dry cleanup has been done, residual contamination can be flushed with plenty of water.

ADDITIONAL COMMENTS

Environmental Toxicity Information:

96-hr LC_{50} (Bluegill) : 440 mg/l, Practically Nontoxic
96-hr LC_{50} (Trout) : 260 mg/l, Practically Nontoxic

DATE: 8/1/83 **REVISED:** X **SUPERSEDES:** 5/78

MSDS NO.: 010101890

FOR ADDITIONAL NON-EMERGENCY INFORMATION, CONTACT:

Product Acceptability Coordinator
Detergent Materials
Monsanto Industrial Chemicals Co.
314-694-2096
(A Unit of Monsanto Company)

Although the information and recommendations set forth herein (hereinafter "Information") are presented in good faith and believed to be correct as of the date hereof, Monsanto Company makes no representations as to the completeness or accuracy thereof. Information is supplied upon the condition that the persons receiving same will make their own determination as to its suitability for their purposes prior to use. In no event will Monsanto Company be responsible for damages of any nature whatsoever resulting from the use of or reliance upon Information. NO REPRESENTATIONS OR WARRANTIES, EITHER EXPRESS OR IMPLIED, OF MERCHANTABILITY, FITNESS FOR A PARTICULAR PURPOSE OR OF ANY OTHER NATURE ARE MADE HEREUNDER WITH RESPECT TO INFORMATION OR THE PRODUCT TO WHICH INFORMATION REFERS.

This form has been approved by the Occupational Safety and Health Administration as "equivalent to" OSHA Form 20.

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
M A T E R I A L   S A F E T Y   D A T A   S H E E T
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

H3880 -03 HYDROCHLORIC ACID ISSUED: 05/16/89
EFFECTIVE: 05/01/89

J.T.BAKER INC., 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865

SECTION I - PRODUCT IDENTIFICATION

PRODUCT NAME: HYDROCHLORIC ACID
COMMON SYNONYMS: MURIATIC ACID; CHLOROHYDRIC ACID; HYDROGEN CHLORIDE, AQUEOUS
CHEMICAL FAMILY: INORGANIC ACIDS
FORMULA: HCL
FORMULA WT.: 36.46
CAS NO.: 7647-01-0
NIOSH/RTECS NO.: MW4025000
PRODUCT USE: LABORATORY REAGENT
PRODUCT CODES: 9530,9546,5537,9529,9543,4800,9539,9547,5367,9535,9549,9548
9537,9544,9540,9534,9542,6900

PRECAUTIONARY LABELING

BAKER SAF-T-DATA* SYSTEM

HEALTH	-	3	SEVERE (POISON)
FLAMMABILITY	-	0	NONE
REACTIVITY	-	2	MODERATE
CONTACT	-	3	SEVERE (CORROSIVE)

LABORATORY PROTECTIVE EQUIPMENT

GOGGLES & SHIELD; LAB COAT & APRON; VENT HOOD; PROPER GLOVES

U.S. PRECAUTIONARY LABELING

POISON DANGER

CAUSES SEVERE BURNS. MAY BE FATAL IF SWALLOWED OR INHALED. DO NOT GET IN EYES, ON SKIN, ON CLOTHING. DO NOT BREATHE VAPOR. CAUSES DAMAGE TO RESPIRATORY SYSTEM (LUNGS), EYES AND SKIN. KEEP IN TIGHTLY CLOSED CONTAINER. LOOSEN CLOSURE CAUTIOUSLY. USE WITH ADEQUATE VENTILATION. WASH THOROUGHLY AFTER HANDLING. IN CASE OF SPILL NEUTRALIZE WITH SODA ASH OR LIME AND PLACE IN DRY CONTAINER.

CONTINUED ON PAGE: 2

J.T.BAKER INC. 222 RED SCHOOL LANE, PHILLIPSBURG, NJ 08865
MATERIAL SAFETY DATA SHEET
24-HOUR EMERGENCY TELEPHONE -- (201) 859-2151
CHEMTREC # (800) 424-9300 -- NATIONAL RESPONSE CENTER # (800) 424-8802

H3880 -03 HYDROCHLORIC ACID ISSUED: 05/16/89
EFFECTIVE: 05/01/89

PRECAUTIONARY LABELING (CONTINUED)

INTERNATIONAL LABELING

IRRITATING TO EYES AND SKIN.
KEEP OUT OF REACH OF CHILDREN. IN CASE OF CONTACT WITH EYES, RINSE IMMEDIATELY WITH PLENTY OF WATER AND SEEK MEDICAL ADVICE.

SAF-T-DATA# STORAGE COLOR CODE: WHITE (CORROSIVE)

SECTION II - COMPONENTS

COMPONENT	CAS NO.	WEIGHT %	OSHA/PEL	ACGIH/TLV
HYDROCHLORIC ACID	7647-01-0	33-40	5 PPM	5 PPM
WATER	7732-18-5	60-67	N/E	N/E

SECTION III - PHYSICAL DATA

BOILING POINT: 110 C (230 F)
(AT 760 MM HG)

VAPOR PRESSURE (MMHG): N/A

MELTING POINT: -25 C (-13 F)
(AT 760 MM HG)

VAPOR DENSITY (AIR=1): 1.3

SPECIFIC GRAVITY: 1.19
(H2O=1)

EVAPORATION RATE: N/A

SOLUBILITY(H2O): COMPLETE (100%)

% VOLATILES BY VOLUME: 100
(21 C)

PH: 1.0 (0.1M SOLUTION)

ODOR THRESHOLD (P.P.M.): N/A

PHYSICAL STATE: LIQUID

COEFFICIENT WATER/OIL DISTRIBUTION: N/A

APPEARANCE & ODOR: CLEAR, COLORLESS FUMING LIQUID. PUNGENT ODOR.

CONTINUED ON PAGE: 3

==
SECTION IV - FIRE AND EXPLOSION HAZARD DATA
==

FLASH POINT (CLOSED CUP): N/A NFPA 704M RATING: 3-0-0

AUTOIGNITION TEMPERATURE: N/A

FLAMMABLE LIMITS: UPPER - N/A LOWER - N/A

FIRE EXTINGUISHING MEDIA
USE EXTINGUISHING MEDIA APPROPRIATE FOR SURROUNDING FIRE.

SPECIAL FIRE-FIGHTING PROCEDURES
FIREFIGHTERS SHOULD WEAR PROPER PROTECTIVE EQUIPMENT AND SELF-CONTAINED BREATHING APPARATUS WITH FULL FACEPIECE OPERATED IN POSITIVE PRESSURE MODE. MOVE CONTAINERS FROM FIRE AREA IF IT CAN BE DONE WITHOUT RISK. USE WATER TO KEEP FIRE-EXPOSED CONTAINERS COOL. DO NOT GET WATER INSIDE CONTAINERS.

UNUSUAL FIRE & EXPLOSION HAZARDS
MAY EMIT HYDROGEN GAS UPON CONTACT WITH METAL.

TOXIC GASES PRODUCED
HYDROGEN CHLORIDE, HYDROGEN

EXPLOSION DATA-SENSITIVITY TO MECHANICAL IMPACT
NONE IDENTIFIED.

EXPLOSION DATA-SENSITIVITY TO STATIC DISCHARGE
NONE IDENTIFIED.

==
SECTION V - HEALTH HAZARD DATA
==

THRESHOLD LIMIT VALUE (TLV/TWA): 7 MG/M3 (5 PPM)

TLV (CEILING) IS FOR HYDROGEN CHLORIDE.

SHORT-TERM EXPOSURE LIMIT (STEL): NOT ESTABLISHED

PERMISSIBLE EXPOSURE LIMIT (PEL): 7 MG/M3 (5 PPM)

(CEILING) IS FOR HYDROGEN CHLORIDE.

CONTINUED ON PAGE: 4

SECTION V - HEALTH HAZARD DATA (CONTINUED)

TOXICITY OF COMPONENTS

INTRAPERITONEAL MOUSE LD50 FOR HYDROCHLORIC ACID	40	MG/KG
ORAL RABBIT LD50 FOR HYDROCHLORIC ACID	900	MG/KG
INHALATION-1HR RAT LC50 FOR HYDROCHLORIC ACID	3124	PPM
INTRAPERITONEAL MOUSE LD50 FOR WATER	190	G/KG
INTRAVENOUS MOUSE LD50 FOR WATER	25	G/KG

CARCINOGENICITY: NTP: NO IARC: NO Z LIST: NO OSHA REG: NO

CARCINOGENICITY
NONE IDENTIFIED.

REPRODUCTIVE EFFECTS
NONE IDENTIFIED.

EFFECTS OF OVEREXPOSURE

INHALATION: PULMONARY EDEMA, CIRCULATORY FAILURE, RESPIRATORY SYSTEM DAMAGE, COLLAPSE, COUGHING, DIFFICULT BREATHING

SKIN CONTACT: SEVERE BURNS

EYE CONTACT: SEVERE BURNS

SKIN ABSORPTION: NONE IDENTIFIED

INGESTION: IS HARMFUL AND MAY BE FATAL, SEVERE BURNS TO MOUTH, THROAT, AND STOMACH, NAUSEA, VOMITING

CHRONIC EFFECTS: NONE IDENTIFIED

TARGET ORGANS
RESPIRATORY SYSTEM, EYES, SKIN

MEDICAL CONDITIONS GENERALLY AGGRAVATED BY EXPOSURE
NONE IDENTIFIED

PRIMARY ROUTES OF ENTRY
INGESTION, INHALATION, SKIN CONTACT, EYE CONTACT

CONTINUED ON PAGE: 5

SECTION V - HEALTH HAZARD DATA (CONTINUED)

MERGENCY AND FIRST AID PROCEDURES

INGESTION: CALL A PHYSICIAN. IF SWALLOWED, DO NOT INDUCE VOMITING. IF CONSCIOUS, GIVE WATER, MILK, OR MILK OF MAGNESIA.

INHALATION: IF INHALED, REMOVE TO FRESH AIR. IF NOT BREATHING, GIVE ARTIFICIAL RESPIRATION. IF BREATHING IS DIFFICULT, GIVE OXYGEN.

SKIN CONTACT: IN CASE OF CONTACT, IMMEDIATELY FLUSH SKIN WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES WHILE REMOVING CONTAMINATED CLOTHING AND SHOES. WASH CLOTHING BEFORE RE-USE.

EYE CONTACT: IN CASE OF EYE CONTACT, IMMEDIATELY FLUSH WITH PLENTY OF WATER FOR AT LEAST 15 MINUTES.

SARA/TITLE III HAZARD CATEGORIES AND LISTS

ACUTE: YES CHRONIC: YES FLAMMABILITY: NO PRESSURE: NO REACTIVITY: NO

EXTREMELY HAZARDOUS SUBSTANCE:	YES	CONTAINS HYDROGEN CHLORIDE (RQ = 1 LB, TPQ = 500 LBS)
CERCLA HAZARDOUS SUBSTANCE:	YES	CONTAINS HYDROCHLORIC ACID (RQ = 5000 LBS)
TOXIC CHEMICALS:	YES	CONTAINS HYDROCHLORIC ACID
GENERIC CLASS:		C16
TSCA INVENTORY:	YES	

SECTION VI - REACTIVITY DATA

STABILITY: STABLE HAZARDOUS POLYMERIZATION: WILL NOT OCCUR

CONDITIONS TO AVOID: HEAT, MOISTURE

INCOMPATIBLES: MOST COMMON METALS, WATER, AMINES, METAL OXIDES, ACETIC ANHYDRIDE, PROPIOLACTONE, VINYL ACETATE, MERCURIC SULFATE, CALCIUM PHOSPHIDE, FORMALDEHYDE, ALKALIES, CARBONATES, STRONG BASES, SULFURIC ACID, CHLOROSULFONIC ACID

MPOSITION PRODUCTS: HYDROGEN CHLORIDE, HYDROGEN, CHLORINE

CONTINUED ON PAGE: 6

SECTION VII - SPILL & DISPOSAL PROCEDURES

STEPS TO BE TAKEN IN THE EVENT OF A SPILL OR DISCHARGE
WEAR SELF-CONTAINED BREATHING APPARATUS AND FULL PROTECTIVE CLOTHING. STOP LEAK IF YOU CAN DO SO WITHOUT RISK. VENTILATE AREA. NEUTRALIZE SPILL WITH SODA ASH OR LIME. WITH CLEAN SHOVEL, CAREFULLY PLACE MATERIAL INTO CLEAN, DRY CONTAINER AND COVER; REMOVE FROM AREA. FLUSH SPILL AREA WITH WATER.

J. T. BAKER NEUTRASORB(R) OR TEAM* "LOW NA+" ACID NEUTRALIZERS ARE RECOMMENDED FOR SPILLS OF THIS PRODUCT.

DISPOSAL PROCEDURE
DISPOSE IN ACCORDANCE WITH ALL APPLICABLE FEDERAL, STATE, AND LOCAL ENVIRONMENTAL REGULATIONS.

EPA HAZARDOUS WASTE NUMBER: D002 (CORROSIVE WASTE)

SECTION VIII - INDUSTRIAL PROTECTIVE EQUIPMENT

VENTILATION:	USE GENERAL OR LOCAL EXHAUST VENTILATION TO MEET TLV REQUIREMENTS.
RESPIRATORY PROTECTION:	RESPIRATORY PROTECTION REQUIRED IF AIRBORNE CONCENTRATION EXCEEDS TLV. AT CONCENTRATIONS UP TO 100 PPM, A CHEMICAL CARTRIDGE RESPIRATOR WITH ACID CARTRIDGE IS RECOMMENDED. ABOVE THIS LEVEL, A SELF-CONTAINED BREATHING APPARATUS IS ADVISED.
EYE/SKIN PROTECTION:	SAFETY GOGGLES AND FACE SHIELD, UNIFORM, PROTECTIVE SUIT, NEOPRENE GLOVES ARE RECOMMENDED.

SECTION IX - STORAGE AND HANDLING PRECAUTIONS

SAF-T-DATA* STORAGE COLOR CODE: WHITE (CORROSIVE)

STORAGE REQUIREMENTS
KEEP CONTAINER TIGHTLY CLOSED. STORE IN CORROSION-PROOF AREA. ISOLATE FROM INCOMPATIBLE MATERIALS. DO NOT STORE NEAR OXIDIZING MATERIALS.

CONTINUED ON PAGE: 7

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SECTION X - TRANSPORTATION DATA AND ADDITIONAL INFORMATION

==

OMESTIC (D.O.T.)

ROPER SHIPPING NAME: HYDROCHLORIC ACID
AZARD CLASS: CORROSIVE MATERIAL (LIQUID)
N/NA: UN1789 REPORTABLE QUANTITY: 5000 LBS.
ABELS: CORROSIVE
EGULATORY REFERENCES: 49CFR 172.101; 173.263

NTERNATIONAL (I.M.O.)

ROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION
AZARD CLASS: 8 I.M.O. PAGE: 8174
UN: UN1789 MARINE POLLUTANTS: NO PACKAGING GROUP: II
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.102; PART 176; IMO

I.C.A.O.)

PROPER SHIPPING NAME: HYDROCHLORIC ACID, SOLUTION
HAZARD CLASS: 8 PACKAGING GROUP: II
UN: UN1789
LABELS: CORROSIVE
REGULATORY REFERENCES: 49CFR 172.101; 173.6; PART 175; ICAO/IATA

U.S. CUSTOMS HARMONIZATION NUMBER: 2806100000

==

N/A = NOT APPLICABLE OR NOT AVAILABLE
N/E = NOT ESTABLISHED

THE INFORMATION IN THIS MATERIAL SAFETY DATA SHEET MEETS THE REQUIREMENTS OF THE UNITED STATES OCCUPATIONAL SAFETY AND HEALTH ACT AND REGULATIONS PROMULGATED THEREUNDER (29 CFR 1910.1200 ET. SEQ.) AND THE CANADIAN WORKPLACE HAZARDOUS MATERIALS INFORMATION SYSTEM. THIS DOCUMENT IS INTENDED ONLY AS A GUIDE TO THE APPROPRIATE PRECAUTIONARY HANDLING OF THE MATERIAL BY A PERSON TRAINED IN, OR SUPERVISED BY A PERSON TRAINED IN, CHEMICAL HANDLING. THE USER IS RESPONSIBLE FOR DETERMINING THE PRECAUTIONS AND DANGERS OF THIS CHEMICAL FOR HIS OR HER PARTICULAR APPLICATION. DEPENDING ON USAGE, PROTECTIVE CLOTHING INCLUDING EYE AND F E GUARDS AND RESPIRATORS MUST BE USED TO AVOID CONTACT WITH MATERIAL REATHING CHEMICAL VAPORS/FUMES.
EXPOSURE TO THIS PRODUCT MAY HAVE SERIOUS ADVERSE HEALTH EFFECTS. THIS CHEMICAL MAY INTERACT WITH OTHER SUBSTANCES. SINCE THE POTENTIAL USES

CONTINUED ON PAGE: 8

==

RE SO VARIED, BAKER CANNOT WARN OF ALL OF THE POTENTIAL DANGERS OF USE
R INTERACTION WITH OTHER CHEMICALS OR MATERIALS. BAKER WARRANTS THAT
HE CHEMICAL MEETS THE SPECIFICATIONS SET FORTH ON THE LABEL.
AKER DISCLAIMS ANY OTHER WARRANTIES, EXPRESSED OR IMPLIED WITH REGARD
O THE PRODUCT SUPPLIED HEREUNDER, ITS MERCHANTABILITY OR ITS FITNESS
OR A PARTICULAR PURPOSE.
HE USER SHOULD RECOGNIZE THAT THIS PRODUCT CAN CAUSE SEVERE INJURY AND
VEN DEATH, ESPECIALLY IF IMPROPERLY HANDLED OR THE KNOWN DANGERS OF USE
RE NOT HEEDED. READ ALL PRECAUTIONARY INFORMATION. AS NEW DOCUMENTED
ENERAL SAFETY INFORMATION BECOMES AVAILABLE, BAKER WILL PERIODICALLY
EVISE THIS MATERIAL SAFETY DATA SHEET. IF YOU HAVE ANY QUESTIONS,
LEASE CALL CUSTOMER SERVICE (1-800-JTBAKER) FOR ASSISTANCE.

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APPROVED BY QUALITY ASSURANCE DEPARTMENT.

-- LAST PAGE --

MALLINCKRODT

Material Safety Data Sheet

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

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Emergency Telephone Number: 314-982-5000

NITRIC ACID, 70%

PRODUCT IDENTIFICATION:

Synonyms: Aqua Fortis; Azotic Acid; Nitric Acid 70%

Formula CAS No.: 7697-37-2

Molecular Weight: 63.00

Chemical Formula: HNO_3

Hazardous Ingredients: Nitric acid

PRECAUTIONARY MEASURES

DANGER! STRONG OXIDIZER. CONTACT WITH OTHER MATERIAL MAY CAUSE FIRE. CORROSIVE. LIQUID AND MIST CAUSE SEVERE BURNS TO ALL BODY TISSUE. MAY BE FATAL IF SWALLOWED. HARMFUL IF INHALED. INHALATION MAY CAUSE LUNG DAMAGE.

Do not get in eyes, on skin, or on clothing.
Avoid breathing mist.
Use only with adequate ventilation.
Wash thoroughly after handling.
Keep from contact with clothing and other combustible materials.
Do not store near combustible materials.
Store in a tightly closed container.
Remove and wash contaminated clothing promptly.
This substance is classified as a POISON under the Federal Caustic Poison Act.

EMERGENCY/FIRST AID

In case of contact, immediately flush skin or eyes with plenty of water for at least 15 minutes. If swallowed, DO NOT INDUCE VOMITING!
Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. If inhaled, remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. In all cases call a physician.
SEE SECTION 5.

DOT Hazard Class: Oxidizer

SECTION 1 Physical Data

Appearance: Clear, colorless to slightly yellow liquid.

Odor: Suffocating acrid.

Solubility: Infinite in water.

Boiling Point: 122°C (252°F)

Melting Point: -34°C (-29°F)

Specific Gravity: 1.41

Vapor Density (Air=1): 2-3 approximately

Vapor Pressure (mm Hg): 62 @ 20°C (68°F)

Evaporation Rate: No information found.

SECTION 2 Fire and Explosion Information

Fire:
Not combustible, but substance is a strong oxidizer and its heat of reaction with reducing agents or combustibles may cause ignition. Can react with metals to release flammable hydrogen gas.

Explosion:
Reacts explosively with combustible organic or readily oxidizable materials such as: alcohols, turpentine, charcoal, organic refuse, metal powder, hydrogen sulfide, etc.

Fire Extinguishing Media:
If involved in a fire, use water spray.

Special Information:
Increases the flammability of combustible, organic and readily oxidizable materials. In the event of a fire, wear full protective clothing and NIOSH-approved self-contained breathing apparatus with full facepiece operated in the pressure demand or other positive pressure mode.

SECTION 3 Reactivity Data

Stability:
Stable under ordinary conditions of use and storage. Containers may burst when heated.

Hazardous Decomposition Products:
When heated to decomposition, emits toxic nitrogen oxides fumes and hydrogen nitrate. Will react with water or steam to produce heat and toxic and corrosive fumes.

Hazardous Polymerization:
Will not occur.

Incompatibilities:
A dangerously powerful oxidizing agent, concentrated nitric acid is incompatible with most substances, especially strong bases, metallic powders, carbides, hydrogen sulfide, turpentine, and combustible organics.

SECTION 4 Leak/Spill Disposal Information

Isolate or enclose the area of the leak or spill. Clean-up personnel should wear protective clothing and respiratory equipment suitable for toxic or corrosive fluids or vapors.
Small Spills: Flush with water and neutralize with alkaline material (soda ash, lime, etc.). Sewer with excess water.
Larger spills and lot sizes: Neutralize with alkaline material, pick up with absorbent material (sand, earth, vermiculite) and dispose in a RCRA-approved waste facility or sewer the neutralized slurry with excess water if local ordinances allow.
Provide forced ventilation to dissipate fumes.

Reportable Quantity (RQ)(CWA/CERCLA) : 1000 lbs.

Ensure compliance with local, state and federal regulations.

AD

NFPA Ratings: Health: 3 Flammability: 0 Reactivity: 0 Other: Oxidizer

NITRIC ACID, 70%

Effective Date: 04-06-89 Supersedes 10-21-86

SECTION 5 Health Hazard Information

A. EXPOSURE / HEALTH EFFECTS

Inhalation:
Corrosive! Inhalation of vapors can cause breathing difficulties and lead to pneumonia and pulmonary edema, which may be fatal. Other symptoms may include coughing, choking, and irritation of the nose, throat, and respiratory tract.

Ingestion:
Corrosive! Swallowing nitric acid can cause immediate pain and burns of the mouth, throat, esophagus and gastrointestinal tract.

Skin Contact:
Corrosive! Can cause redness, pain, and severe skin burns. Concentrated solutions cause deep ulcers and stain skin a yellow or yellow-brown color.

Eye Contact:
Corrosive! Vapors are irritating and may cause damage to the eyes. Splashes may cause severe burns and permanent eye damage.

Chronic Exposure:
Long-term exposure to concentrated vapors may cause erosion of teeth. Long term exposures seldom occur due to the corrosive properties of the acid.

Aggrevation of Pre-existing Conditions:
Persons with pre-existing skin disorders or eye disease may be more susceptible to the effects of this substance.

B. FIRST AID

Inhalation:
Remove to fresh air. If not breathing, give artificial respiration. If breathing is difficult, give oxygen. Call a physician.

Ingestion:
DO NOT INDUCE VOMITING! Give large quantities of water or milk if available. Never give anything by mouth to an unconscious person. Get medical attention immediately.

Skin Exposure:
In case of contact, immediately flush skin with plenty of water for at least 15 minutes while removing contaminated clothing and shoes. Wash clothing before reuse. Thoroughly clean shoes before reuse. Get medical attention immediately.

Eye Exposure:
Wash eyes with plenty of water for at least 15 minutes, lifting lower and upper eyelids occasionally. Get medical attention immediately.

C. TOXICITY DATA (RTECS, 1986)

Inhalation (Rat) LC50: 244 ppm (NO_2)/30M

SECTION 6 Occupational Control Measures

Airborne Exposure Limits:
-OSHA Permissible Exposure Limit (PEL):
2 ppm (TWA), 4 ppm (STEL)
-ACGIH Threshold Limit Value (TLV):
2 ppm (TWA); 4 ppm (STEL)

Ventilation System:
A system of local and/or general exhaust is recommended to keep employee exposures below the Airborne Exposure Limits. Local exhaust ventilation is generally preferred because it can control the emissions of the contaminant at its source, preventing dispersion of it into the general work area. Please refer to the ACGIH document, "Industrial Ventilation, A Manual of Recommended Practices", most recent edition, for details.

Personal Respirators: (NIOSH Approved)
If the TLV is exceeded, wear a supplied air, full-facepiece respirator, airlined hood, or self-contained breathing apparatus. Nitric acid is an oxidizer and should not come in contact with cartridges and cannisters that contain oxidizable materials, such as activated charcoal.

Skin Protection:
Wear impervious protective clothing, including boots, gloves, lab coat, apron or coveralls to prevent skin contact.

Eye Protection:
Use chemical safety goggles and/or a full face shield where splashing is possible. Contact lenses should not be worn when working with this material. Maintain eye wash fountain and quick-drench facilities in work area.

SECTION 7 Storage and Special Information

Keep in a tightly closed container, stored in a cool, dry, ventilated area. Protect from physical damage and direct sunlight. Isolate from incompatible substances. Protect from moisture.

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Emergency Telephone Number: 314-982-5000

Mallinckrodt, Inc. Science Products Division, P.O. Box M Paris, KY 40361

Addendum to Material Safety Data Sheet

REGULATORY STATUS

This Addendum Must Not Be Detached from the MSDS

Identifies SARA 313 substance(s)

Any copying or redistribution of the MSDS must include a copy of this addendum

(Chem.Key: NITRA)

Hazard Categories for SARA Section 311/312 Reporting

Acute	Chronic	Fire	Pressure	Reactive
X	X			X

Product or Components of Product:	SARA EHS Sect. 302 RQ (lbs.)	SARA EHS Sect. 302 TPQ (lbs.)	SARA Section 313 Chemicals Name List	SARA Section 313 Chemicals Chemical Category	CERCLA Sec.103 RQ (lbs.)	RCRA Sec. 261.33
NITRIC ACID, 70% (7697-37-2)	1000	1,000	Yes	No	1000	No

SARA Section 302 EHS RQ: Reportable Quantity of Extremely Hazardous Substance, listed at 40 CFR 355.

SARA Section 302 EHS TPQ: Threshold Planning Quantity of Extremely Hazardous Substance. An asterisk (*) following a Threshold Planning Quantity signifies that if the material is a solid and has a particle size equal to or larger than 100 micrometers, the Threshold Planning Quantity = 10,000 LBS.

SARA Section 313 Chemicals: Toxic Substances subject to annual release reporting requirements listed at 40 CFR 372.65.

CERCLA Sec. 103: Comprehensive Enviromental Response, Compensation and Liability Act (Superfund). Releases to air, land or water of these hazardous substances which exceed the Reportable Quantity (RQ) must be reported to the National Response Center, (800-424-8802); Listed at 40 CFR 302.4

RCRA: Resource Conservation and Reclamation Act. Commercial chemical product wastes designated as acute hazards and toxic under 40 CFR 261.33

JOB SAFETY & HEALTH PROTECTION

The Occupational Safety and Health Act of 1970 provides job safety and health protection for workers by promoting safe and healthful working conditions throughout the Nation. Requirements of the Act include the following:

EMPLOYERS

All employers must furnish to employees employment and a place of employment free from recognized hazards that are causing or are likely to cause death or serious harm or employees. Employers must comply with occupational safety and health standards issued under the Act.

EMPLOYEES

Employees must comply with all occupational safety and health standards, rules, regulations and orders issued under the Act that apply to their own actions and conduct on the job.

The Occupational Safety and Health Administration (OSHA) of the U.S. Department of Labor has the primary responsibility for administering the Act. OSHA issues occupational safety and health standards, and its Compliance Safety and Health Officers conduct jobsite inspections to help ensure compliance with the Act.

INSPECTION

The Act requires that a representative of the employer and a representative authorized by the employees be given an opportunity to accompany the OSHA inspector for the purpose of aiding the inspection.

Where there is no authorized employee representative, the OSHA Compliance Officer must consult with a reasonable number of employees concerning safety and health conditions in the workplace.

COMPLAINT

Employees or their representatives have the right to file a complaint with the nearest OSHA office requesting an inspection if they believe unsafe or unhealthful conditions exist in their workplace. OSHA will withhold, on request, names of employees complaining.

The Act provides the employees may not be discharged or discriminated against in any way for filing safety and health complaints or for otherwise exercising their rights under the Act. Employees who believe they have been discriminated against may file a complaint with their nearest OSHA office within 30 days of the alleged discriminatory action.

CITATION

If upon inspection OSHA believes an employer has violated the Act, a citation alleging such violations will be issued to the employer. Each citation will specify a time period within which the alleged violation must be corrected.

The OSHA citation must be prominently displayed at or near the place of alleged violation for three days, or until it is corrected, whichever is later, to warn employees of dangers that may exist there.

PROPOSED PENALTY

The Act provides for mandatory civil penalties against employers of up to $7,000 for each serious violation and for optional penalties of up to $7,000 for each nonserious violation. Penalties of up to $7,000 per day may be proposed for failure to correct violations within the proposed time period and for each day the violation continues beyond the prescribed abatement date. Also, any employer who willfully or repeatedly violates the Act may be assessed penalties of up to $70,000 for each such violation. A violation of posting requirements can bring a penalty of up to $7,000.

There are also provisions for criminal penalties. Any willful violation resulting in the death of any employee, upon conviction, is punishable by a fine of up to $250,000 (or $500,000 if the employer is a corporation), or by imprisonment for up to six months, or both. A second conviction of an employer doubles the possible term of imprisonment. Falsifying records, reports, or applications is punishable by a fine of $10,000 or up to six months in jail or both.

VOLUNTARY ACTIVITY

While providing penalties for violations, the Act also encourages efforts by labor and management, before an OSHA inspection, to reduce workplace hazards voluntarily and to develop and improve safety and health programs in all workplaces and industries. OSHA's Voluntary Protection Programs recognize outstanding efforts of this nature.

OSHA has published Safety and Health Program Management Guidelines to assist employers in establishing or perfecting programs to prevent or control employee exposure to workplace hazards. There are many public and private organizations that can provide information and assistance in this effort, if requested. Also, your local OSHA office can provide considerable help and advice on solving safety and health problems or can refer you to other sources for health such as training.

VOLUNTARY ACTIVITY

Free assistance in identifying and correcting hazards and in improving safety and health management is available to employers, without citation or penalty, through OSHA-supported programs in each State. These programs are usually administered by the State labor or Health department or a State university.

POSTING INSTRUCTIONS

Employees in States operating OSHA approved State Plans should obtain and post the State's equivalent poster.

Under provisions of Title 29, Code of Federal Regulations, Part 1903.2(a)(1) employers must post this notice (or facsimile) in a conspicuous place where notices to employees are customarily posted.

More Information

Additional information and copies of the Act, specific OSHA safety and health standards, and other applicable regulations may be obtained from your employer or from the nearest OSHA Regional Office in the following locations:

Atlanta, Georgia	(404) 347-3573
Boston, Massachusetts	(617) 565-7164
Chicago, Illinois	(312) 353-2220
Dallas, Texas	(214) 767-4731
Denver, Colorado	(303) 844-3061
Kansas City, Missouri	(816) 426-5861
New York, New York	(212) 337-2378
Philadelphia, Pennsylvania	(215) 596-1201
San Francisco, California	(415) 744-6670
Seattle, Washington	(206) 442-5930

Washington, D.C.
1991 (Reprinted)
OSHA 2203

Lynn Martin, Secretary of Labor
U.S. Department of Labor
Occupational Safety and Health Administration

To report suspected fire hazards, imminent danger safety and health hazards in the workplace, or other job safety and health emergencies, such as toxic waste in the workplace, call OSHA's 24-hour hotline: 1-800-321-OSHA.

N.6 DAILY HEALTH AND SAFETY AUDIT

ite Name: ______________________________ Date: ______________

uditor: ______________________________

ALL DEFICIENCIES MUST BE CORRECTED IMMEDIATELY!

	YES	NO	N/A	COMMENTS
				Use back of form if more space is needed
1. Safety meeting held today?				
2. Emergency procedures discussed during safety meeting?				
3. Vehicle available on-site for transportation to the hospital?				
4. At least two persons trained in CPR and first-aid on-site?				
5. Proper PPE being worn as specified in the HASP?				
Level of PPE being worn: ______________				
6. PPE adequate for work conditions?				
If not, give reason: ______________				
Upgrade/downgrade to PPE level: ______________				
7. If Level B, back-up/emergency person suited up (except for air)?				
8. Monitoring equipment calibrated?				
9. Monitoring equipment in good condition?				
10. Monitoring equipment used properly?				
11. Other monitoring equipment needed?				
List: ______________				
12. Monitoring equipment covered with plastic to minimize contamination?				
Decon line set up properly?				
Proper cleaning fluid used for known or suspected contaminants?				
15. Proper decon procedures used?				
16. Decon personnel wearing proper PPE?				
17. Equipment decontaminated?				
18. Samples decontaminated?				
19. Disposable items changed twice a day or more often if needed?				
20. Proper collection and disposal of contaminated PPE?				
21. Proper collection and disposal of decon fluid?				
22. Buddy system used?				
23. Equipment kept off drums and ground?				
24. Kneeling or sitting on drums or ground not allowed?				
25. Personnel avoid standing or walking through puddles or stained soil?				
26. Zones established?				
27. If night work to be conducted, adequate illumination?				
28. Smoking, eating, or drinking in the Exclusion Zone or CRZ not allowed?				
29. To the extent feasible, contaminated materials handled remotely?				
30. Entry into excavations not allowed unless properly shored or sloped?				
31. All unusual situations on-site listed in HASP?				
If not, what? ______________				
Action taken? ______________				
HASP revised? ______________				
32. All confined spaces identified?				
If not, list: ______________				
Confined Space Checklists used?				
Confined Space Checklists completely and correctly filled out?				

APPENDIX O RESPIRATORY PROTECTION PROGRAM

O RESPIRATORY PROTECTION PROGRAM

O.1 INTRODUCTION

This program was developed to govern the selection and use of respiratory protective devices by ABB Environmental personnel. The program is intended to comply with OSHA requirements as set forth in 29 CFR 1910.134(b). The scope of this program is limited to activities related to field investigations of potentially hazardous waste disposal sites.

O.2 PERSONNEL REQUIREMENTS

All personnel assigned to field activities at hazardous or potentially hazardous locations are currently required by ABB Environmental's health and safety policies to be enrolled in the corporate health monitoring program. Part of this program involves spirometry, a measure of the respiratory system status. No personnel may be assigned to the use of or may withdraw from stock any respiratory protective device without a physician's certification that use of the device will not be injurious to health. Psychological limitations (e.g., claustrophobia) are also considered in personnel assignments. Training in the use of the selected device and fit testing, as described herein, are also required.

Personnel will not be assigned duties that require a respirator when facial hair, skullcaps, or eyeglasses will interfere with a proper fit. Contact lenses may not be worn with any respiratory protective device. Eyeglass frames that fit inside the respirator facepiece are provided as necessary.

O.3 APPLICABLE EQUIPMENT

ABB Environmental maintains the following respiratory protective equipment:

- full-face chemical/mechanical air-purifying respirators
- SCBA
- full-face airline-supplied breathing apparatus
- 5-minute escape air supply

This equipment is intended for use on an as-needed basis, to be determined by an evaluation of on-site conditions. Respiratory protective equipment should not be used arbitrarily by any ABB Environmental personnel. Selection criteria are presented separately; training is required in the use of each type of equipment before drawing from stock.

O.4 Personnel Training

Training of personnel in the proper use and care of respiratory protective equipment is considered essential to the success of the program. Training encompasses the following topics:

- respiratory protection principles
- selection of appropriate equipment
- use of equipment
- maintenance of equipment
- fit testing

Information regarding each topic is presented as standard respiratory protection procedures in the corporate health and safety program manual.

O.5 Program Administration and Documentation

Administration of the ABB Environmental Respiratory Protection Program is the responsibility of the HSM, and includes the following:

- respirator selection
- personnel training
- fit testing
- respirator maintenance
- documentation
- program evaluation and improvements
- personnel pulmonary testing and certification

Fit testing and respirator maintenance is performed by the equipment manager of ABB Environmental's Sample Control and Staging Center in Portland, Maine, and designated, trained employees at the other offices. All fit-testing and respirator maintenance is conducted under the administration of the HSM. Major maintenance is performed by manufacturer-certified technicians only. Personnel training in respiratory protection is one aspect of the HSM's ongoing personnel training programs. Program evaluation is a dynamic process, occurring each time a project HASP is prepared.

Medical supervision of personnel occurs as part of the ABB Environmental health monitoring program, also administered by the HSM. Medical surveillance is required for all personnel assigned to hazardous or potentially hazardous site activities.

Documentation of the various elements of the ABB Environmental respiratory protection program is achieved through several media, as follows:

- Documentation of respirator selection is included in the hazard assessment of each site's HASP.
- Documentation of personnel training is maintained in both hardcopy and computerized files.
- Documentation of medical surveillance is achieved indirectly by maintaining a list of enrolled employees in the health monitoring program, and directly through physician certification of personnel allowed to be assigned respiratory protective devices.
- Using the appropriate form, documentation of fit-testing is maintained on file with the equipment manager of the Sample Control and Staging Center and with the HSM or designee.
- Documentation of site surveillance is required both by this program and by the HASP for each site. Records of site surveillance are created by the HSO and maintained in project files.
- Respirator inspection and maintenance records are created and maintained by the equipment manager for each respirator, SCBA, and escape respirator.

Inspection and documentation occurs either before each unit is removed from stock and when it is returned, or monthly.

O.6 INSPECTION, MAINTENANCE, AND STORAGE

O.6.1 Introduction

Respirator maintenance is an integral part of the overall respirator program. Wearing a poorly maintained or malfunctioning respirator, in one sense, is more dangerous than not wearing a respirator at all. Personnel wearing defective devices think they are protected when, in reality, they are not. Emergency escape and rescue devices are particularly vulnerable to poor maintenance because they generally are used infrequently, and then in the most hazardous and demanding circumstances. Serious injury or death can result from wearing a defective device during an emergency escape or rescue. The respirator program includes the following components:

- inspection for defects (including a leak check)
- cleaning and disinfecting
- repair as required
- proper and sanitary storage of equipment

O.6.2 Inspection for Defects

The most important part of a respirator maintenance program is continual inspection of the devices. If properly performed, inspections will identify damaged or malfunctioning respirators before they can be used. Two types of inspections will be performed: (1) while the respirator is in use, and (2) while it is being cleaned. Because the use and cleaning will be performed primarily by the same personnel, these inspections may become concurrent.

O.6.3 Frequency of Inspection

OSHA requires that "All respirators be inspected before and after each use," and that those not used routinely (i.e., emergency escape and rescue devices) "shall be inspected after each use and at least monthly...." Obviously, emergency escape and rescue devices do not require inspection before each use.

O.6.4 Inspection Procedures

Respirator inspection will include checking of the following:

- tightness of the connections
- facepiece
- valves
- connecting tubes
- canisters, filters, or cartridges

In addition, the regulator and warning devices on a SCBA will be checked for proper functions.

O.6.5 Field Inspection of Air-purifying Respirators

Routinely used air-purifying respirators will be checked as follows before and after each use:

1. Examine the facepiece for:

   - excessive dirt
   - cracks, tears, holes, or physical distortion of shape from improper storage
   - inflexibility of rubber facepiece (stretch and knead to restore flexibility)
   - cracked or badly scratched lenses in full facepieces
   - incorrectly mounted full facepiece lenses, or broken or missing mounting clips
   - cracked or broken air-purifying element holder(s), badly worn threads, or missing gasket(s)

2. Examine the head straps or head harness for:

- breaks
- loss of elasticity
- broken or malfunctioning buckles and attachments
- excessively worn serrations on head harness, which might permit slippage (full facepieces only)

3. Examine the exhalation valve for the following after removing the cover:

- foreign material (e.g.,detergent residue, dust particles, or human hair under valve seat)

- cracks, tears, or distortion in the valve material

- improper insertion of the valve body in the facepiece

- cracks, breaks, or chips in the valve body, particularly the sealing surface

- missing or defective valve cover

- improper installation of the valve in the valve body

4. Examine the air-purifying element(s) for:

- incorrect cartridge, canister, or filter for the hazard

- incorrect installation, loose connections, missing or worn gasket, or cross-threading in the holder

- expired shelf-life date on the cartridge or canister

- cracks or dents in the outside case of the filter, cartridge, or canister indicated by the absence of sealing material, tape, or foil over the inlet

- identical cartridges if more than one are used

O.6.6 Care and Cleaning of Self-contained Breathing Apparatus

The proper care of SCBAs involves the following:

- inspection for defects
- cleaning and disinfecting
- repair
- storage

The following checklist is to be used by personnel whenever they check out a SCBA. (Note: Any discrepancy found should be cause to set the unit aside until it can be repaired by a certified repairperson.)

1. Preliminary Inspection. Check to ensure that:

   - high-pressure hose connector is tight on cylinder fitting
   - bypass valve is closed
   - mainline valve is closed
   - there is no cover or obstruction on regulator outlet
   - pressure in the tank is at least 1,800 psi

2. Backpack and Harness Assembly.

   - Straps

     - visually inspect for complete set
     - visually inspect for frayed or damaged straps that may break during use

   - Buckles

     - visually inspect for mating ends
     - check locking function

   - Backplate and Cylinder Lock

     - visually inspect backplate for cracks and for missing rivets or screws

- Breathing Tube and Connector

  - Stretch breathing tube and visually inspect for deterioration and holes.

  - Visually inspect connector to ensure good condition of threads and for presence and proper condition of "O" ring or rubber gasket seal.

  - Perform a negative pressure test on facepiece.

    a. Don backpack and facepiece.

    b. With facepiece held tightly to face or facepiece properly donned, stretch breathing tube to open corrugations and place thumb or hand over end of connector.

    c. Inhale. Negative pressure should be created inside mask, causing it to pull tightly to face. This negative pressure should be maintained for 5 to 10 seconds. If negative pressure leaks down, the facepiece assembly is not adequate and should not be worn.

6. Storage of Units. Check that:

   - cylinder is refilled as necessary and unit is cleaned and inspected
   - cylinder valve is closed
   - high-pressure hose connector is tight on cylinder
   - pressure is bled off high-pressure hose and regulator
   - bypass valve is closed
   - mainline valve is closed
   - all straps are completely loosened and laid straight

- facepiece is properly stored to protect against dust, sunlight, heat, extreme cold, excess moisture, and damaging chemicals

O.6.7 Cleaning and Sanitizing

Any good detergent may be used, followed by a disinfecting rinse or a combination disinfectant-detergent for a one-step operation. Reliable, effective disinfectants can be made from readily available household solutions, including the following:

- Hypochlorite solution (50 ppm of chlorine) can be made by adding approximately 2 milliliters of bleach (e.g., Clorox) to 1 liter of water, or 2 tablespoons of bleach per gallon of water. A 2-minute immersion disinfects the respirators.

- Aqueous solution of iodine (50 ppm of iodine) can be made by adding approximately 0.8 milliliter of tincture of iodine per liter of water, or 1 teaspoon of tincture of iodine per gallon of water. A 2-minute immersion is sufficient to disinfect the respirators.

To prevent damaging the rubber and plastic in the respirator facepieces, the cleaning water should not exceed 140°F; however, to ensure adequate cleaning, it should not be less than 120°F.

O.6.8 Rinsing

The cleaned and disinfected respirators should be rinsed thoroughly in water (140°F maximum) to remove all traces of detergent and disinfectant. This is important for preventing dermatitis.

O.6.9 Drying

The respirators may be allowed to dry in room air on a clean surface. They may also be hung from a horizontal wire, like drying clothes; however, care must be taken not to damage or distort the facepieces.

- visually inspect cylinder hold-down strap and physically check strap tightener and lock to ensure that it is fully engaged

3. Cylinder and Cylinder Valve Assembly.

- Cylinder

  - physically check cylinder to ensure that it is tightly fastened to backplate
  - check hydrostatic test date to ensure that it is current
  - visually inspect cylinder for large dents or gouges in metal

- Head and Valve Assembly

  - visually inspect cylinder for presence of valve lock
  - visually inspect cylinder gauge for condition of face, needle, and lens
  - open cylinder valve and listen or feel for leakage around packing (if leakage is noted, do not use until repaired); note function of valve lock

4. Regulator and High-pressure Hose.

- High-pressure Hose and Connector. Listen or feel for leakage in hose or at hose-to-cylinder connector. (Bubble in outer hose covering may be caused by seepage of air through hose when stored under pressure. This does not necessarily mean a faulty hose.)

- Regulator and Low-pressure Alarm

  - Cover outlet of regulator with palm of hand. Open mainline valve and read regulator gauge (must read at least 1,800 psi and not more than rated cylinder pressure).

  - Close cylinder valve and slowly move hand from regulator outlet to allow slow flow of air. Gauge should begin to show immediate loss of pressure as air flows. Low-pressure alarm should sound between 650 and 550 psi. Remove hand completely from outlet and close mainline valve.

- Place mouth onto or over regulator outlet and blow. A positive pressure should be created and maintained for 5 to 10 seconds without any loss of air. Next, establish a slight negative pressure in regulator and hold for 5 to 10 seconds. Vacuum should remain constant. This tests the integrity of the diaphragm. Any loss of pressure or vacuum during this test indicates a leak in the apparatus.

- Open cylinder valve.

- Place hand over regulator outlet and open mainline valve. Remove hand from outlet and replace in rapid movement. Repeat twice. Air should escape when hand is removed each time, indicating a positive pressure in chamber. Close mainline valve and remove hand from outlet.

- Ascertain that no obstruction is in or over the regulator outlet. Open and close the bypass valve momentarily to ensure flow of air through bypass system.

5. Facepiece and Corrugated Breathing Tube.

    - Facepiece

        - Visually inspect head harness for damaged serrations and deteriorated rubber. Visually inspect rubber facepiece body for signs of deterioration or extreme distortion.

        - Retaining clamp properly in place, visually inspect lens for proper seal in rubber facepiece, and for cracks or large scratches.

        - Visually inspect exhalation valve for visible deterioration or foreign materials buildup.

O.6.10 Reassembly and Inspection

To avoid contamination, the clean, dry respirator facepieces should be reassembled and inspected in an area separate from the disassembly area. The inspection procedures were discussed previously; special emphasis should be given to inspecting the respirators for detergent or soap residue left by inadequate rinsing. This appears most often under the seat of the exhalation valve, and can cause valve leakage or sticking. The respirator should be thoroughly inspected and all defects corrected. New or retested cartridges and canisters should be installed, and the completely reassembled respirator should be tested for leaks. For SCBA devices, the facepiece should be combined with the tested regulator and the fully charged cylinder, and an operational check should be performed.

O.6.11 Maintenance and Repair

Replacement or repair should be done only by trained, experienced persons using parts designed for the respirator. Besides being contrary to OSHA requirements, substitution of parts from a different brand or type of respirator invalidates approval of the device. This restriction applies particularly to maintenance of the more complicated devices, especially SCBA, and more specifically, regulator valves and low-pressure warning devices. These devices should be returned to the manufacturer or to a trained technician for adjustment or repair. No problems are anticipated in repairing and maintaining most simple respirators, particularly the commonly used air-purifying type.

O.6.12 Respirator Storage

Respirators must be stored properly to protect against the following:

- dust
- sunlight
- heat
- extreme cold
- excessive moisture
- damaging chemicals
- mechanical damage

Damage and contamination of respirators may occur if they are stored on a workbench; in a tool cabinet or toolbox among heavy tools, greases, and dirt; or in a vehicle.

APPENDIX P OTHER

P OTHER

P.1 ILLUMINATION

Site operations will not be permitted without adequate lighting. Therefore, unless provisions are made for artificial light, downrange operations must halt in time to permit personnel and equipment to exit the Exclusion Zone and proceed through decontamination before dusk. Conversely, operations will not be permitted to begin until lighting is adequate.

P.2 SANITATION

Provisions must be made for sanitation facilities for the site work force. At a minimum, the provision of toilet facilities must meet the requirements of 29 CFR 1910.120(n), which includes one facility for less than 20 employees, or one toilet and one urinal for every 40 employees, up to 200; then one of each for every 50 employees. If it is a mobile crew and they have transport readily available, the requirements do not apply.

P.3 HEALTH AND SAFETY AUDIT PROCEDURES

Regular health and safety audits will be conducted to ensure compliance with health and safety policy and procedures. The HSO will perform periodic audits, with the goal of one audit per shift, using the health and safety audit form (see Appendix N). Auditing may be performed on any ABB Environmental site by the HSS or the HSM, and will include health and safety evaluations of all work activities. The audits will be an unannounced evaluation of sites selected at the discretion of the HSM or HSS, with the goal of 10 percent of active sites being subject to audits each quarter.

Results of each site health and safety audit will be summarized in an audit report provided to the site HSO, the Project Manager, and the Operational Group Manager charged with responsibility for the project. Where the audit report identifies deficiencies, it will be the Project Manager's responsibility to promptly implement corrective action. The corrective action undertaken will be outlined in a written report submitted to the HSS and the HSM. The HSM or the HSS will retain the original audit report that has been signed by the Project Manager and the HSO to acknowledge receipt of the audit's findings. Any mitigating comments submitted to the HSM or the HSS will be appended to the original report.

APPENDIX Q STANDARD OPERATING PROCEDURES

Q STANDARD OPERATING PROCEDURES

Q.1 STANDARD OPERATING PROCEDURES FOR THE USE OF EXPLOSIVES IN SEISMIC REFRACTION SURVEYS

Q.1.1 Introduction

This appendix lists some of the more important aspects of the purchase, transport, storage, handling, and use of explosives. it is intended as a general guide for ABB Environmental personnel who may be involved in conducting seismic surveys or who may be overseeing or auditing such surveys. It is not intended as a stand-alone reference replacing appropriate federal and/or state regulations, which can be very specific about certain aspects regarding explosives.

Many recent advances in computer software and hardware and hardware technology have revolutionized data processing and interpretating in the seismic industry. Likewise, the recent development of sophisticated (and very expensive) truck-mounted energy sources that can scan a large range of frequencies for optimum response from deep reflecting horizons has made possible reflection surveys for hydrocarbon deposits to depths of up to 20 kilometers. However, for shallow (i.e., the upper several hundred feet) seismic refraction surveys, the best and most economical energy source continues to be small explosive charges detonated with electric blasting caps.

A small explosive charge, as defined herein, consists of the equivalent of from 1/8 to 1 pound of dynamite which is primed for detonation with one or more electric blasting caps. The "dynamite" that ABB Environmental generally uses is KINESTIK 1/3, which consists of a powder and liquid, mixed on-site to form an explosive similar in performance to dynamite. Each stick (86 to a case) is equivalent to 1/3 pound of dynamite. Before mixing, the two parts re not considered by the DOT to he explosive; therefore, they can be shipped, transported, and stored with no special precautions. In practice, ABB Environmental personnel should take every precaution to ensure that the powder and liquid are separated while being stored for any length of time to prevent unauthorized access to potentially explosive materials.

Electric blasting caps come in two configurations acceptable for seismographic work. The "seismograph" variety is best because of its repeatability with regard to delay time (i.e., the time that elapses between when the "fire" button on the blaster is depressed and when the blasting cap actually detonates). The other type is known as "instantaneous," and it has acceptable delay time characteristics. Blasting caps are graded by the federal government (and all states) a Class A explosive and must be handled and stored accordingly. Requirements for Class A explosive are discussed in the following subsection.

Q.1.2 Purchase, Transport, and Storage

The federal government has specific guidelines regarding the purchase, transport, and storage of explosives, particularly regarding interstate commerce. In addition, each state has developed regulations that supersede federal regulations if they are more restrictive. Therefore, the user must become familiar with federal as well as state regulations. In practice, it is unlikely that ABB Environmental would ever become involved in interstate activities regarding explosives. In fact, it has been ABB Environmental's practice to subcontract out-of-state blasting activities to a local blaster to minimize expenses that would otherwise be incurred in obtaining necessary permits, and to eliminate time expended to purchase, transport, and store explosives. The following subsections pertain to State of Maine requirements. Other states can be and are different from Maine, and requirements vary widely.

Q.1.2.1 Purchase. In the State of Maine, a blasting license for an individual is not required. Such a license is required in Massachusetts (a competency license) and New York (an explosives license). However, the State of Maine does require a written permit, issued by the Commissioner of Public Safety, for the transport of explosives in intrastate commerce in quantities larger than 200 pounds of dynamite, or more than 500 electric blasting caps. Although ABB Environmental never transport quantities exceeding these amounts, it has been company policy to obtain the State Permit to Transport Explosives, because it provides additional credibility to explosives vendors and local officials.

Before purchasing explosives in Maine, the user must obtain a permit from the fire marshal or appropriate local official in the town in which the explosives are to be used and/or stored. The local official must first establish the identity of the applicant, verify that he or she is older than 21 years of age and is a U.S. citizen, and inquire about the intended use of the explosives. Permitting thorough local officials can be as easy as a courtesy telephone call from the official notifying the local fire department or police chief (every town or city handles explosives permitting a little differently).

Before selling explosives, the state requires the vendor to verify that a valid permit has been issued to the buyer by the appropriate local town official. In addition, the vendor should ascertain whether the buyer can comply with the rules and regulations relative to the transport of explosives.

Q.1.2.2 Transport. Before issuing the State Permit to Transport Explosives, officials from the Department of Public Safety in Augusta, Maine, inspect the vehicle driven by the applicant to ensure that it is roadworthy. They also inspect the explosives magazine in which the explosives will be locked while in transit. State regulations require that the magazine be constructed of 1-and-1/2-inch-thick planking with no exposed metal on the inside (to eliminate sparks) and sheathed with NO. 24-gauge galvanized sheet steel. The magazine should have a strong hasp and padlock and be locked at all times when explosives are being transported. The magazine should also be chained and locked within the vehicle to prevent removal or shifting while under way. In addition, the vehicle should be equipped front and rear with two 1-quart (minimum) fire extinguishers suitable to extinguish electrical fires, and four diamond-shaped Class "A" explosives signs mounted on the front and rear and both sides of the vehicle. ABB Environmental owns a "day" magazine and other equipment that meets these requirements.

Q.1.2.3 Storage. Regulations are very specific regarding storage. All that ABB Environmental personnel need to remember is Class "A" explosives must be returned for storage to a permanent or temporary magazine before sunset on each day of usage. The ABB Environmental day magazine is not a permanent or temporary magazine. A permanent magazine is a substantial structure located well away from dwellings and buildings where people work or congregate. It has walls 4 to 8 inches thick (depending on method of construction), strong doors with interior hinges, and double-shielded locks specially designed for storage magazines. The roof is construct^Ed to be bullet-proof, and foundation requirements are also specified. A temporary magazine is usually a rather massive steel box (i.e., 350 to 500 pounds or more) on casters, lined with thick wood planking, with double-shielded locks. It should be securely fastened to the ground.

Q.1.3 Handling and Use

Safety should be the foremost consideration whenever explosives are being used. Seismic surveys routinely expend 20 to 30 sticks of dynamite (and an equal number of electric blasting caps) during a single field day. To mix the KINESTIK, mix one "tube" of the KINESTICK liquid (a clear red liquid composed of nitromethane) with one "stick" of white powder (ammonium nitrate), and allow to stand until the powder is thoroughly saturated with the liquid (it becomes pink); this takes 5 to 10 minutes. If the upper 4 feet of overburden are wet or saturated, it is a good idea to seal the stick (equipped with a screw cap) with tape to prevent contamination by groundwater. If groundwater enters the stick, it can cause the KINESTIK to misfire.

While the KINESTIK is being mixed, a series of shotholes (usually five) are prepared by driving a pointed 1-and-3/4-inch steel bar to the desired depth (from 2 to 4 or 5 feet) with a sledgehammer. The shothole depth depends on soil conditions and the anticipated size of the charge. Only when the explosives are ready to be placed at the bottom of a shothole, a blasting cap is placed in a molded cavity at the base of each stick. The blasting cap has two lead wires, usually 8 or 12 feet long, which are grounded together with a removable metal shield that should be left in place until the primed shot is ready to be fired. This prevents the induction of elect^Rc charge, which could accidentally fire the cap. The lead wires are used to connect the blasting cap to a double conductor (i.e., "shot") wire leading to the blaster. The cap is secured to the KINESTIK by two or more half-hitches with the two cap lead wires.

The explosive is not "primed" for detonation. After the primed shot is placed at the bottom of the shothole, a small amount of native soil (preferably sand) is placed in the hole and gently tamped with a tamping stick into the base of the hole over the primed explosive charge. A proper tamping stick is wooden (non-sparking), about 6 feet long and 1 to 1-1/4 inches in diameter (Note: dowel stock works well). The tamping procedure continues until a uniform column of native soil completely fills the shothole. One should be careful not to damage the cap lead wires during the tamping process.

The removal metal shield grounding the two cap lead wires together is removed only when the shot is ready to fire. Prior to making the connection between the cap lead wire and the shot wire leading to the blaster, the person making the connection should ascertain that the shot wire has been sorted out as the blaster by the party chief (operating the blaster) so that inadvertent detonation is not possible). While making the connection, the lead wires should be extended as far from the shothole as possible. The person making the connection should turn his or her back to the shothole, remove the metal grounding shield, and attach the shot wire leads (no polarity) to the cap wire leads.

As each shot is detonated, one person (usually the one making the connection) should be assigned to verify that no one is near the shot. The party chief should then call out, "Are you clear (of the shot)?" The response, "all clear" indicates that everything is ready and no one is close enough to be in any danger when the shot is detonated. A "safe" distance varies with soil conditions and the depth of the shot; 75 to 100 feet is generally adequate. The party chief then calls out to everyone in the area, "Fire in the hole," and the charge is detonated.

If a misfire occurs (extremely rare), it is the responsibility of the party chief to remove the undetonated charge from the ground with a nonsparking shovel of wood or brass. The party chief is responsible for maintaining an explosives log that documents all explosives purchased, expended, stored, and destroyed. This log is subject to inspection at any time by local, state, and federal officials. It provides a record detailing the disposition of every cap and stick of dynamite (or KINESTIK) that comes under the control of ABB Environmental personnel.

The amount of explosives that can be loaded into a shothole depends on the nature of the surface materials and the depth of the water table. Some general rules follow:

- use as few explosives as necessary to produce good quality data
- the more granular the soils, the more explosives will be required (to produce good data); the finer the soils, the fewer will be required
- the deeper the water table, the more explosives required, and vice versa
- the deeper the bedrock, the more explosives will be required, and vice versa

When ascertaining the proper explosive charge to produce good data at a new site, it is good practice to start with a single shothole well away from any buildings and power lines, and perform a test shot to determine local soil (an energy transmission) characteristics. Start with a small charge (e.g., half a stock of KINESTIK, obtained by mixing half the liquid from one tube with half the powder form one stick) buried to moderate depth (e.g., 3 feet) and increase (or decrease) the amount of the charge (and the depth of the shothole) as necessary.

APPENDIX R BLOODBORNE PATHOGEN STANDARD EXPOSURE CONTROL PLAN

R BLOODBORNE PATHOGEN STANDARD EXPOSURE CONTROL PLAN

R.1 INTRODUCTION

On December 6, 1991, the Occupational Safety and Health Administration (OSHA) issued a final standard on Occupational Exposure to Bloodborne Pathogens with an effective date of March 6, 1992. This standard is intended to protect all workers who may reasonably anticipate being occupationally exposed to blood and other potentially infectious materials. Occupational exposure means a "reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from the performance of the workers duties."

ABB Environmental Services Inc. (ABB-ES) has developed this EXPOSURE CONTROL PLAN (ECP) to help protect its associates from being inadvertently exposed to the hepatitis B virus (HBV) or human immunodeficiency virus (HIV). This ECP applies to all associates bearing current first aid or cardiopulmonary resuscitation (CPR) certification or who will work at a hazardous waste site containing medical wastes. The ECP supplemented by training will help associates become aware of the hazards to which they may be exposed and how to reduce exposure incidents. This plan will be reviewed and updated at least annually, or whenever necessary, to reflect new or modified tasks and procedures affecting occupational exposure. In addition, site-specific procedures must be addressed in the Health and Safety Plan HASP for all sites potentially containing medical wastes.

R.2 EXPOSURE DETERMINATION

During the normal course of their work, ABB-ES associates would not routinely become exposed to bloodborne pathogens (e.g., viruses). Circumstances where exposure may occur would be when providing first aid/CPR treatment (see Personnel Master Training List for associates currently certified) or when working at a hazardous waste site containing medical wastes. (Note: Project Assistants who are in health monitoring and have received Project Assistant training and who will be handling samples potentially contaminated with bloodborne pathogens will also be covered by the standard.)

R.2.1 Routes of Exposure

The infectious process can best be compared to a chain with six interrelated links, all of which must be present for an infection to take place.

R.2.1.1 Infectious Agent. The first link is the etiologic agent itself. This would include any bacterium, fungus, virus, or other microorganism. Not only must the organism must be present, it must also be pathogenic and present in sufficient quantity to provide an infective dose. Seldom, if ever, has the transmission of disease resulted from the transfer of a single microorganism. It usually requires thousands to millions of such agents before infection can take place. The actual number required depends on the pathogen in question.

R.2.1.2 Reservoir. The second major link is the presence of a reservoir or source that allows for microbial survival and, perhaps, even multiplication of a potential pathogen. Common reservoirs would include not only humans, but also the equipment used in medical treatment. While HIV cannot survive long outside the body, HBV becomes dormant and can survive for years.

R.2.1.3 Portal of Exit. The third link is the presence of a source from which the pathogen can emerge, a portal of exit. Obvious portals of exit include the respiratory tract, vascular system, skin and mucous membranes, as well as the gastrointestinal tract and genitourinary tracts. Each of these portals of exit is particular to a given disease. For example, tuberculosis and influenza would involve only the respiratory tract, and typhoid fever the gastrointestinal tract.

R.2.1.4 Mode of Transmission. The fourth link, a mode of transmission, is one over which there is a great deal of control. This link is, by far, the easiest to break. Transmission can occur in one of four ways: contact; airborne; vehicular; and vector (vector transmission involves the transmission of pathogens via insect, animal, or plant vectors) modes of spread.

The transfer of infectious agents through vehicular means (e.g., food or water borne) is not a common event. Nonetheless, it can and does occur.

The airborne route transmits many diseases (e.g., tuberculosis, measles, mumps, and chicken pox). Controlling the airborne spread of disease usually involves good ventilatory patterns and caution when coming into close proximity with infected individuals (e.g., when providing first aid or CPR).

The major mode of disease transfer is contact transmission. This takes place either through direct or indirect contact, or through droplet spread involving contact with exhaled respiratory secretions. Direct contact, person-to-person transmission, is primarily person-to-person spread through actual physical contact. Indirect contact transmission can be the result of contact with a contaminated, intermediate object such as medical wastes in a landfill. Droplet spread can occur as the result of contact with respiratory secretions through means such as sneezing or coughing.

R2.1.5 Portal of Entry. The fifth link in the chain is a suitable portal of entry. As with chemical exposures, these portals are inhalation, ingestion, dermal, and injection. Most infectious diseases and infectious conditions require very specific portals of entry.

R2.1.6 Susceptible Host. The last major link involves the necessity for a susceptible host, someone who lacks effective resistance to a given pathogenic agent. A variety of host factors must be met before infection can occur. Very few organisms can gain entrance through normal intact skin. Most require some breach in skin integrity. Other less obvious lines of defense include tears, gastric acid, and cilia of the nose and upper respiratory tract. One's ability to mount a local inflammatory response provides yet another non-specific host defense mechanism.

There are, however, several biologic factors that decrease, rather than increase, a resistance to infection. Extremes in age, either the very young or very old, are associated with decreased resistance. Other factors such as major surgery and the presence of chronic diseases-diabetes, neoplasia, blood disorders - alter host resistance. Malnutrition, anemia, and chronic alcoholism also have pronounced effects on the ability to combat disease.

R.2.2 Bloodborne Pathogens of Concern

R2.2.1 Hepatitis B Virus. The term "hepatitis" simply means an inflammation of the liver. This condition can be caused by a wide variety of agents, including medication, alcohol, toxic or poisonous substances, and infectious agents such as viruses. Hepatitis B, formerly known as "serum" hepatitis, is the only form of viral hepatitis that poses a significant occupational threat.

Nationwide, there are approximately 300,000 new cases of hepatitis B infection each year and about 5,000 deaths caused by this disease. Approximately 5 percent of the entire U.S. population, more than 12 million people, have been infected. The carrier rate is approximately 10 percent. It is estimated that, in the United States alone, there are approximately 750,000 to 1,000,000 asymptomatic carriers of the virus. The hepatitis B virus has been found in blood, semen, vaginal secretions, breast milk, saliva, and serous fluid. In occupational settings, the major route into the body is from blood or blood-contaminated bodily fluids splashed into the eyes, mucous membranes, or mouth.

There is a direct relationship between the likelihood of occupational hepatitis B infection and the frequency of blood contact. It is the frequency of blood contact that establishes the level of risk of being infected with HBV.

R.2.2.2 Human Immunodeficiency Virus. Acquired immunodeficiency syndrome or AIDS is a severe viral disease. AIDS severely affects the immune system and is characterized by a multitude of opportunistic infections. The AIDS or HIV virus is typical of most viruses in that it cannot survive for any appreciable amount of time outside its human host. Its presence in the general environment is extremely unlikely and occupationally would be limited to body secretions, primarily blood. Being an unstable virus, HIV is very susceptible to a large number of common household disinfectants.

Over the past decade, approximately 210,000 cases of AIDS have been reported in the United States. In addition, an estimated 1 million individuals have been infected with the virus but have not yet developed the disease. It is important to remember that these individuals are generally without symptoms, yet they are carriers of the virus and thus potentially infectious.

R.3 METHODS OF CONTROL

As a result of increased epidemiologic knowledge concerning HIV and HBV transmissions, the Centers for Disease Control recommended that all blood or bodily fluids be considered potentially infectious. This approach has come to be known as "Universal Precautions." The concept of Universal Precautions recognizes that medical histories and examinations cannot reliably identify all patients infected with HIV or other bloodborne pathogens nor can you recognize those individuals on site, thereby dictating certain precautionary measures when providing first aid or CPR to any worker.

Wherever feasible, engineering and work practice controls will be used to eliminate or minimize employee exposure. Where occupational exposure remains after institution of these controls, personal protective equipment will also be used.

R.3.1 Engineering controls

If engineering controls are utilized (e.g., remote handling of contaminated materials), they will be examined and maintained or replaced on a regular schedule to confirm their effectiveness.

R.3.2 Work Practices

Work practices that will be used at sites include:

1. Handwashing facilities with soap and running water. If a site does not have access to running water, an antiseptic hand cleanser in conjunction with clean cloth/paper towels or antiseptic toweletts will be provided. When antiseptic hand cleansers or toweletts are used, hands shall be washed with soap and running water as soon as feasible.

2. No eating, drinking, smoking, applying lip balm or cosmetics, and handling contact lenses are allowed in the Exclusion Zone or immediately after providing first aid or CPR.

3. Associates are to wash their hands, or any other exposed skin, with soap and water as soon as feasible after any exposure to any potentially infectious material and before eating, drinking, smoking, applying lip balm or cosmetics, and before handling contact lenses. Flush mucous membranes with water immediately or as soon as feasible following body contact with blood or any other potentially infectious material.

4. Equipment that is contaminated with blood or other potentially infectious material will be decontaminated prior to exiting the Exclusion Zone or as soon as feasible after

providing first aid treatment. Equipment that cannot be decontaminated immediately will be labeled as a biohazard until such a time as decontamination can take place.

5. All procedures involving blood or other potentially infectious materials will be performed in such a manner as to minimize splashing, spraying, spattering, and generating droplets of these substances.

6. Samples containing potentially infectious material shall be placed in a container that prevents leakage during collection, handling, processing, storage, transport, or shipping. If outside contamination of the primary container occurs, the primary container shall be placed within a second container that also prevents leakage.

R.3.3 Personal Protective Equipment

Modified Level D (Level C - dermal) is the minimum level of personal protection to be used at a hazardous waste site suspected to contain medical wastes. When providing first aid treatment, gloves, safety goggles/glasses, and coveralls/tyveks will be worn at a minimum. Level C or B can be used if face shields are unavailable.

Personal protective equipment (PPE), is only considered appropriate if it does not permit blood or other potentially infectious materials to pass through or to reach an associate's work clothes, street clothes, undergarments, skin, eyes, mouth, or other mucous membranes under normal conditions of use and for the duration of time the protective equipment is used. First aid kits will be stocked with safety glasses, gloves, and disposable mouthpieces (with one-way valves) for use when providing CPR.

All PPE will be removed before leaving the Exclusion Zone or immediately after first aid treatment has concluded. All disposable PPE will be collected and labeled as a biohazard and disposed of properly. ABB-ES will collect, bag, and label (red bags or bags with biohazard label), launder, and decontaminate all non-disposable PPE. Should blood or other potentially infectious materials penetrate the garment, the worker will remove it immediately or as soon as feasible.

R3.3.1 Gloves. Gloves shall be worn when it can reasonably be anticipated that the associate may have hand contact with blood, other potentially infectious materials, mucous membranes, and non-intact skin; or when handling or touching contaminated items or surfaces. The gloves typically used at hazardous waste sites are acceptable.

R3.3.2 Eye Protection and Face Shields. Eye protection devices, such as goggles or glasses with solid side shields, or chin-length face shields, shall be worn whenever splashes, spray, spatter, or droplets of blood or other potentially infectious materials may be generated.

R3.3.3 Protective Clothing. Clothing such as, but not limited to, tyveks, polycoated tyveks, aprons, and coveralls, or similar outer garments shall be worn when providing first aid or working on a site where medical wastes are suspected or known to be. The type of clothing selected will be based on the task, degree of exposure anticipated, and other hazards (e.g., chemicals) present at the site.

R.4 DECONTAMINATION AND DISPOSAL

R.4.1 Decontamination

All equipment and work surfaces shall be cleaned and decontaminated after contact with blood or other potentially infectious materials. Contaminated work surfaces shall be decontaminated with an appropriate disinfectant (such as chlorine bleach) after completion of procedures; immediately or as soon as feasible when surfaces are overtly contaminated or after any spill of blood or other potentially infectious materials; and at the end of the work shift. Protective coverings, such as plastic wrap, aluminum foil, or imperviously-backed absorbent paper used to cover equipment and environmental surfaces, shall be removed and replaced as soon as feasible when they become overtly contaminated or at the end of the day.

All bins, pails, cans, coolers, etc., intended for reuse that have a reasonable likelihood for becoming contaminated with blood or other potentially infectious materials shall be inspected, decontaminated, and disinfected (with chlorine bleach) immediately or as soon as feasible.

Broken glassware or other sharp objects that may be contaminated shall not be picked up directly with hands. These shall be cleaned using mechanical means, such as a brush and dust pan, tongs, shovel, etc.

R.4.2 Disposal

Contaminated sharps (e.g., broken sample bottles) shall be discarded immediately or as soon as feasible in containers that are: (1) closable; (2) puncture-resistant: (3) leakproof on sides and bottom; and (4) labeled or color-coded.

Other regulated wastes (e.g., gloves, tyveks) shall be placed in containers that are: (1) closable; (2) constructed to contain all contents and prevent leakage of fluids during handling, storage, transport, or shipping; (3) labeled or color-coded; and (4) closed prior to removal to prevent spillage or protrusion of contents during handling, storage, transport, or shipping. If outside contamination of the regulated waste container occurs, it shall be placed in a second container that meets the qualifications of the primary container.

Disposal of all regulated wastes shall be in accordance with applicable regulations.

R.4.3 Laundry

Disposable items shall be used whenever possible. In the event that coveralls or street clothing becomes contaminated with potentially infectious materials, it shall be laundered by a facility capable of handling potentially infectious materials.

Contaminated laundry shall be handled as little as possible with a minimum of agitation. All contaminated laundry shall be bagged or containerized without being sorted or rinsed at the location where it was used. Contaminated laundry shall be placed and transported in bags or containers labeled or color-coded. Whenever contaminated laundry is wet and presents a reasonable likelihood of soak-through of or leakage from the bag or container, the laundry shall be placed and transported in bags or containers that prevent soak-through and/or leakage of fluids to the exterior. All associates who have contact with the laundry shall wear protective gloves and other appropriate PPE.

R.5 LABELS

Signs and labels used to indicate potentially infectious materials must include the following legend:

These labels shall be fluorescent orange or orange-red or predominantly so, with lettering or symbols in contrasting color and affixed as close as feasible to the container by string, wire, adhesive, or other methods that prevents their loss or unintentional removal.

Warning labels containing the above symbol must be affixed to containers of regulated waste, coolers, laundry bags, or other containers used to store, transport, or ship blood or other potentially infectious materials. A substitute for labels is the use of red bags or containers. These can be used to differentiate between infectious and non-infectious materials as long as all associates at the site are aware of its meaning.

Labels required for contaminated equipment will contain the biohazard symbol and shall also state which portions of the equipment remain contaminated. Refer to Figure R-1.

R.6 TRAINING

All associates maintaining current certification in first aid and/or CPR as well as associates who are assigned to a site potentially contaminated with medical wastes will be trained in the contents of this ECP. This training will include:

1. The hazards involved from being exposed to potentially contaminated blood and other bodily fluids, including a general explanation of the epidemiology and symptoms of bloodborne diseases and an explanation of the modes of transmission of bloodborne pathogens.
2. The hepatitis B vaccine.
3. Appropriate work practices and engineering controls.
4. Proper personal protective equipment.
5. Proper housekeeping, transportation, and disposal of contaminated wastes and proper disposal or laundering of personal protective equipment.

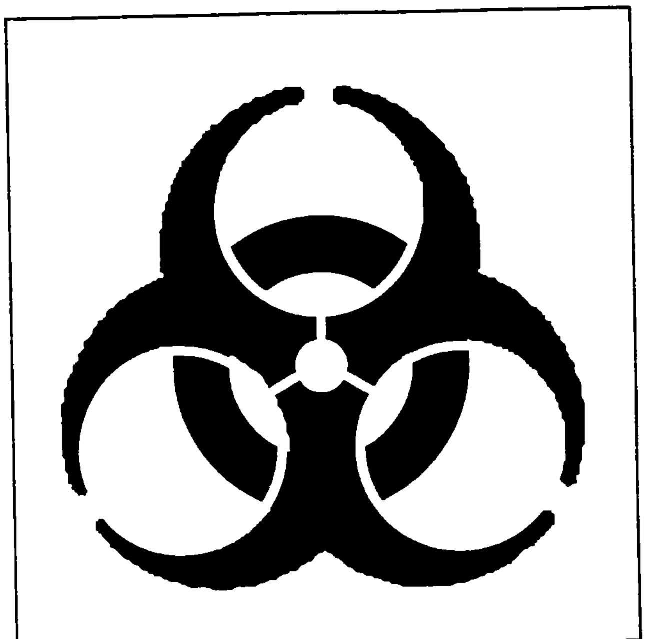

Figure R-1: Biohazard Symbol

6. Actions to take if worker comes in contact with blood or other potentially infectious material.

7. An explanation of the signs, labels, and/or color-coding required.

Training will be done at the time of initial employment and annually thereafter during refresher training courses. Additional training will be conducted when working at sites suspected of containing medical wastes or when otherwise needed.

R.7 EXPOSURE INCIDENT

R.7.1 Vaccination

All associates working at hazardous waste sites where medical wastes are a potential contaminant and who will be working in the Exclusion Zone, handling samples, or who otherwise may come in contact with potentially contaminated materials, must be offered a Hepatitis B vaccination series 10 days prior to working at the site. In addition, all associates who, during the course of providing first aid or CPR, come in contact with blood or other potentially infectious bodily fluids, are to be offered a hepatitis vaccine within 24 hours of exposure regardless of whether PPE was worn.

R.7.2 Exposure Notification

Should an occupational exposure to blood or other potentially infectious bodily fluids occur, the Health and Safety Manager (HSM) will be notified immediately. Should the exposure occur after normal hours or over the weekend, the Health and Safety Officer (HSO) will contact our health monitoring provider, Health Resources, Inc. at 1-800-350-4511 to arrange for the hepatitis B vaccine at a nearby clinic or hospital. Exceptions to this policy are only for associates who have already received the complete vaccine series and antibody testing has revealed that they are immune, or if the vaccine is inadvisable for medical reasons.

If the associate declines the hepatitis B vaccination, the associate must sign the "Hepatitis B Vaccine Declination" statement (Figure R-2) before being allowed to work at the site or within 24 hours of exposure after providing first aid or CPR.

Figure R-2: Declination Form For Hepatitis B Vaccine

ABB ENVIRONMENTAL SERVICES, INC.

DECLINATION FORM FOR HEPATITIS B VACCINE

I understand that due to my occupational exposure to blood and other potentially infectious materials I may be at risk of acquiring hepatitis B virus (HBV) infection. I have been given the opportunity to be vaccinated with hepatitis B vaccine at no charge to me. However, I decline hepatitis B vaccination at this time. I understand that by declining this vaccine, I continue to be at risk of acquiring hepatitis B, a serious disease. If in the future I continue to have occupational exposure to blood or other potentially infectious materials and I want to be vaccinated with hepatitis B vaccine, I can receive the vaccination series at no charge to me.

Employee Signature:______________________________

Social Security Number:______________________________

Date:______________________________

Signature of Witness:______________________________

Any associate who initially declines the vaccine is still eligible to take it at a later date. The vaccine will be available at no charge to the associate.

R.7.3 Post-Exposure Evaluation and Follow-Up

Hepatitis B vaccinations are available, at no charge, to all ABB-ES associates who have current certification in first aid or CPR and have had an occupational exposure to blood or other potentially infectious bodily fluids or who work at sites where there is a potential for an exposure to medical wastes.

After the occurrence of an occupational exposure, a post-exposure follow-up examination will occur. All medical evaluations and procedures are performed under the supervision of Health Resources and will be conducted at the health monitoring clinic normally used by ABB-ES associates or a clinic or hospital near the site. All evaluations, procedures, vaccinations, and post-exposure management will be conducted according to current standard recommendations of U.S. Public Health Service.

Following a report of an exposure incident, each associate will immediately receive a confidential medical evaluation and follow-up. Included in this examination will be the following elements:

1. Documentation of the route(s) of exposure, and the circumstances under which the exposure incident occurred.

2. Identification and documentation of the source individual, unless ABB-ES can establish that identification is infeasible or prohibited by state or local law.

3. Testing the source individual's blood as soon as possible for HBV. Testing for HIV is performed only after consent is obtained. If consent is not obtained, document that legally required consent cannot be obtained as needed. When the source individual is already known to be infected with HBV or HIV, this testing does not need to be repeated.

4. Results of the source individual's testing will be made available to the exposed associate, and the associate will be informed of applicable laws and

regulations concerning disclosure of the identity and the infectious status of the source individual.

5. The exposed associate's blood will be collected and tested after consent is obtained. If the associate consents to baseline blood collection but does not give consent at that time for HIV serologic testing, the sample is preserved for at least 90 days. If within 90 days of the exposure incident, the associate elects to have the baseline sample tested, the testing is done as soon as feasible.

6. High-risk exposure involves blood or body fluids introduced through intact skin or splashed onto mucous membranes or broken or abraded skin of the associate. Any associate sustaining a high-risk exposure should notify the HSM immediately.

7. Follow-up of the exposed associate includes any or all of the following: (a) antibody or antigen testing; (b) counseling; (c) illness reporting; and (d) safe and effective post-exposure measures to prevent the spread of disease.

8. Health Resources already has or will be provided the following information:

   a. A copy of the Bloodborne Pathogen Standard and it's appendices (29 CFR 1910.1030).

   b. A description of the affected associates's duties as they relate to the exposure.

   c. Documentation of the route(s) of exposure and circumstances under which exposure occurred.

   d. Results of the source individual's tests if available.

   e. All medical records relevant to the appropriate treatment of the associate including vaccination status.

9. A physician's written opinion will be sent to the associate with a copy to the HSM within 15 days of the completion of the evaluation. The written opinion to the HSM will be limited to:

b. a statement that the associate has been informed of the results of the medical evaluation; and

c. a statement that the associate has been told about any medical conditions resulting from exposure to blood or other potentially infectious materials that require further evaluation or treatment.

All other findings and diagnoses will remain confidential and will not be included in the HSM's copy of the written report.

APPENDIX S HANDLING DRUMS AND CONTAINERS

S HANDLING DRUMS AND CONTAINERS

S.1 INTRODUCTION

One of the more dangerous tasks an associate can conduct at a hazardous waste site is the inspection and handling of drums or other hazardous waste containers. Before shipment and disposal, the contents of all drums and containers must be identified and classified. On a hazardous waste site, this can mean sampling unlabeled drums or containers with unknown contents. When the contents are unknown, the worker must assume the contents are hazardous and act accordingly.

Many hazards are associated with the inspection and handling of drums and containers. These include fires, explosions, vapor generation, and physical injury from moving heavy containers by hand and working around stacked drums, heavy equipment, and deteriorated drums. While these hazards are always present, steps can be taken to minimize their risks.

S.2 INSPECTION

If at all possible, drums and containers will be inspected and their integrity assured before being moved. Drums or containers that cannot be inspected before being moved because of storage conditions (e.g., buried beneath the earth, or stacked several tiers high in a pile) will be moved to an accessible location and inspected before further handling. The drums will be inspected and evaluated for:

- DOT labels, words, or other marks indicating the contents
- Signs of deterioration
- Drum type
- Configuration of the drumhead
- Airborne contaminant levels

S.2.1 DOT Labels, Words, or Other Markings

DOT labels, words, or other markings will indicate if the contents are hazardous, for example, radioactive, explosive, corrosive, toxic, or flammable, or whether the drum contains discarded laboratory chemicals, reagents, or other potentially dangerous materials in small-volume individual containers.

S.2.2 Signs of Deterioration

Signs of deterioration include corrosion, rust, and leaks that could indicate the drum is unsafe to move.

S.2.3 Drum Types

Drum types indicate contents. For instance, polyethylene- or PVC-lined drums often contain strong acids or bases. Drums made of unusual metals such as aluminum, nickel, stainless steel usually contain extremely dangerous materials. Single-walled drums, which are used as pressure vessels and have fittings for both product filling and placement of an inert gas, can contain reactive, flammable, or explosive substances. Laboratory packs used to dispose of expired chemicals and process samples can contain incompatible materials, radioisotopes, shock-sensitive, highly volatile, highly corrosive, or very toxic chemicals.

S.2.4 Drum Configuration

The configuration of the drum head indicates the state of the contents. For instance, drums on which the whole lid is removable are designed to contain solid materials. Drums that have a bung are designed to contain liquids. Drums with liners can contain highly corrosive or otherwise hazardous materials.

S.2.5 Airborne Contaminant Levels

Additional information will be obtained through monitoring instrumentation. The breathing zone and area around the drums will be monitored with instruments such as the photoionization detector (PID), radiation survey meter, flame ionization detector (FID), combustible gas indicator and so forth. The results of this survey will be used to help classify the drums into preliminary hazard categories such as:

- Radioactive
- Leaking/deteriorated
- Bulging
- Explosive/shock-sensitive
- Laboratory waste

The worker must keep in mind that drums often are mislabeled, particularly if they have been reused: therefore, even clearly labeled drums should be handled with care and the contents considered suspect.

S.3 DRUM HANDLING

Accidents frequently occur during the handling of drums, particularly the initial handling. To minimize the risks of an accident, the handling of drums will be kept to a minimum until the contents have been identified and characterized. Prior to handling, all personnel will be warned about the hazards and instructed to minimize and avoid handling drums as much as possible. Some reasons workers would have for handling unidentified drums include:

- Responding to an obvious problem that might impair worker safety (e.g., radioactivity, leakage, or the presence of explosive substances)

- Unstacking and orienting drums for sampling

- Organizing drums into different areas on the site to facilitate characterization and remedial action

In all phases of handling, personnel will be alert for new information about potential hazards and will respond to these hazards before continuing with more routine handling operations. DOT-approved overpack drums and a large volume of absorbent will be kept near areas where minor spills could occur. Where major spills can occur, a containment berm adequate to contain the entire volume of liquid in the drums will be constructed before any handling takes place. If the drum contents spill, only personnel trained in spill response will be used to isolate and contain the spill.

S.3.1 Equipment

Several types of equipment can be used to move drums:

- A drum grappler attached to a hydraulic excavator
- A small front-end loader, which can be either loaded manually or equipped with a bucket sling
- A rough terrain forklift
- A roller conveyor equipped with solid rollers
- Drum carts designed specifically for drum handling

The drum grappler is the preferred piece of equipment for drum handling because it keeps the operator removed from the drums so there is less likelihood of injury if the drums detonate or rupture. If a drum is leaking, the operator can stop the leak by rotating the drum and immediately placing it into an overpack. In case of an explosion, grappler claws help protect the operator by partially deflecting the force. No matter which of the above is used, it will be selected, positioned, and operated to minimize sources of ignition in relation to flammable vapors being released from ruptured drums or containers.

S.3.2 Safety Procedures

The following procedures will be used to maximize worker safety during drum handling and movement:

- Personnel will be trained in proper lifting and moving techniques to prevent back injuries. Drum handling equipment, described in Subsection S.3.1, will be used whenever possible.
- The vehicles selected to handle drums and containers will have rated load capacities sufficient to handle the anticipated loads and will be selected to operate smoothly on the available road surface.

- Air-conditioned vehicle cabs will be used if possible. The vehicle operator will be provided with heavy splash shields.

- Vehicle operators will be required to wear appropriate personal protective equipment. Normally either a combination SCBA/SAR with the air tank fastened to the vehicle, or an airline respirator with an escape SCBA are used because of the high potential hazard of drum handling. This improves operator efficiency and provides protection in case the operator must abandon the equipment.

- DOT-approved overpacks will be available before attempting to move drums.

- Before handling the drums, a determination will be made of the most appropriate sequence in which the various drums and other containers should be moved. For example, small containers might have to be removed first to permit heavy equipment to enter and move the drums.

- Extreme caution will be used in handling drums that are not intact and tightly sealed.

- Vehicle operators must have a clear view of the roadway when carrying drums. Where necessary, ground workers will be available to guide the operator's motion.

S.3.3 Special Handling Procedures

S.3.3.1 Radioactive Waste. If the drum exhibits radiation levels above background, immediately contact the HSM. Do not handle any radioactive drums until personnel with expertise in this area have been consulted.

S.3.3.2 Explosive or Shock-Sensitive Waste. If a drum contains or is suspected of containing explosive or shock-sensitive waste (as determined by visual inspection or from the background investigation), associates will seek specialized assistance before handling. If handling is deemed necessary, workers will handle the drum with extreme caution and use the following precautions:

- All nonessential personnel will be moved a safe distance away.

- Either a grappler unit constructed for explosive containment of drums, or a protective shield, if manual handling is necessary, will be used to protect the equipment operators from exploding containers.

- Drums will be palletized and secured prior to transport.

- An audible siren signal system, similar to that employed in conventional blasting operations, will be used to signal the commencement and completion of explosive waste handling activities.

- Continuous communication will be maintained with the HSO and the command post until drum handling operations are complete. Care must be taken in selecting the communication method because some communication equipment or methods could cause shock sensitive materials to explode.

S.3.3.3 **Bulging Drums**. Pressurized drums are extremely hazardous. Whenever possible, do not move drums that could be under internal pressure, as evidenced by bulging or swelling. If a pressurized drum has to be moved, only move it after the cause of the excess pressure has been determined and appropriate containment procedures have been implemented. Handle the drum with a grappler unit constructed for explosive containment. Either move the bulged drum only as far as necessary to allow seating on firm ground, or carefully overpack the drum. Exercise extreme caution when working with or adjacent to potentially pressurized drums.

S.3.3.4 Laboratory Packs. Laboratory Packs (i.e., drums containing individual containers of laboratory material) can ignite fires at hazardous waste sites, and sometimes contain shock-sensitive materials. Such containers should be considered to hold explosive or shock-sensitive wastes until otherwise characterized. If handling is required, the following precautions are among those that will be taken:

- All nonessential personnel will be moved a safe distance away prior to handling or transporting laboratory packs.

- Whenever possible, a grappler unit constructed for explosive containment will be used for the initial handling of such drums.

- Continuous communication will be maintained with the HSO and the command post until handling operations are complete.

- The laboratory pack will only be opened when necessary. If opened, a chemist who is knowledgeable about hazardous wastes will inspect, classify, and segregate the bottles within it according to the hazards of the wastes. **Workers will not open the individual bottles within the laboratory pack.** The containers will be packed with sufficient cushioning and absorption materials to prevent excessive movement of the bottles and to absorb all free liquids.

- If crystalline material is noted at the neck of any bottle, it is to be considered shock-sensitive waste. An expert will be called in for advice before attempting to handle it. This is due to the potential presence of picric acid or similar material.

- The repacked drums will be palletized and secured prior to transport.

S.3.3.5 Leaking, Open, and Deteriorated Drums. If a drum containing a liquid cannot be moved without rupture, its contents will be immediately transferred to a sound drum using a pump designed for transferring that liquid. A drum grappler will be used to immediately place a drum in an overpack container if: (1) the drum is leaking and contains sludges or semisolids; (2) it is open and contains liquid or solid wastes; or (3) if it is deteriorated, but can be moved without rupture.

S.3.3.6 Buried Drums. A ground-penetrating system will be used to estimate the location and depth of the drums before initiating subsurface excavation. To minimize the potential for drum rupture, great caution will be used when removing the soil. A dry chemical extinguisher will be on hand to control small fires.

S.4 OPENING DRUMS

Whenever possible, drums will be opened and sampled before moving them. If the drums must be handled before sampling, extreme caution will be used and the procedures followed as outlined in Subsection S.3. Regardless of whether the drums are opened before or after handling, the opening procedures are the same. To enhance the efficiency and safety of drum-opening personnel, the following procedures will be instituted:

- Unless background information warrants the use of a lower level of personal protective equipment, the opening of drums is to be done at Level B. Airline respirators with an escape SCBA will be used whenever possible, as this enables workers to operate in relative comfort for extended periods. When airline respirators are used, the connections to the source of air will be protected from contamination and the entire system protected from physical damage.

- Personnel will be protected by keeping them at a safe distance from the drums being opened. If personnel must be located near the drums, explosion-resistant plastic shields will be used to protect them in case of detonation. The controls for drum opening equipment, monitoring equipment, and fire suppression equipment will be located behind the explosion-resistant plastic shields.

- If there is a reasonable potential for a flammable atmosphere to exist, intrinsically safe and non-sparking tools will be used.

- If possible, continuous monitoring will be conducted during a drum opening. The sensors of the monitoring equipment, such as colorimetric tubes, dosimeter, radiation survey instruments, explosion meters, organic vapor analyzers, and oxygen meters, will be placed as close as possible to the source of contaminants (i.e., at the drum opening).

- Remote-controlled devices will be used to open drums whenever possible. These devices include: (1) a pneumatically operated impact wrench to remove drum bungs; (2) a hydraulically or pneumatically operated drum piercers, and

(3) backhoes equipped with bronze spikes for penetrating drum tops in large-scale operations.

- **Picks, chisels, or firearms will not be used to open drums.**

- The drum opening equipment will be hung or balanced, whenever possible, to minimize worker exertion.

- If the drum shows signs of swelling or bulging, all steps will be performed slowly. Excess pressure will be relieved prior to opening and, if possible, from a remote location using devices such as a pneumatic impact wrench or hydraulic penetration device. If pressure must be relieved manually, a barrier such as explosion-resistant plastic sheeting will be placed between the worker and bung to deflect any gas, liquid, or solids that could be expelled as the bung is loosened.

- Special metal drums and polyethylene- or PVC-lined drums will be opened through the bung by removal or drilling. Extreme caution will be exercised when manipulating these containers.

- **Workers will not open or sample the individual containers within laboratory packs.**

- Open bungs and drill openings will be resealed as soon as possible with new bungs or plugs to avoid explosions and/or vapor generation. If an open drum cannot be resealed, the drum will be placed into an overpack. Any openings in pressurized drums will be plugged with pressure-venting caps set to a 5-pounds-per-square-inch (psi) release to allow venting of vapor pressure.

- Equipment will be decontaminated after each use to avoid mixing incompatible wastes.

S.5 SAMPLING

Because it often involves direct contact with unidentified wastes, sampling drums can be one of the most dangerous activities a hazardous waste site worker can be exposed to. Before the collection of any sample, a complete sampling plan will be developed to include:

- A thorough background investigation to gather all available information about the waste.

- A determination of which drums, if not all, should be sampled.
- A selection of the appropriate sampling device(s) and container(s).
- Standard Operating Procedures for opening drums, sampling, and sample packaging and transportation.
- The required personal protective equipment based on available information about the wastes and site conditions.

When manual sampling is required, the following procedures must also be included:

- Sampling personnel will be kept at a safe distance while drums are being opened and will sample only after opening operations are complete.
- **Workers will not lean over other drums to reach the drum being sampled, unless absolutely necessary.**
- Drum tops will be covered with plastic sheeting or other suitable noncontaminated materials, if appropriate, to avoid excessive contact with the drum tops.
- **Workers will not stand on drums.** This is extremely dangerous. Mobile steps or another platform will be used to achieve the height necessary to safely sample from the drums.
- Samples will be obtained with either glass rods or vacuum pumps. **Contaminated items, such as discarded rags, will not be used to sample as the sample can become contaminated and the contaminant might not be compatible with the waste in the drum, causing a reaction or explosion.** Glass rods will be removed prior to pumping to minimize the damage to pumps.

S.6 STAGING

Although every attempt will be made to minimize drum handling, drums must sometimes be staged to facilitate characterization and remedial action, and to protect drums from potentially hazardous site conditions (e.g., movement of heavy equipment and high temperatures that might cause explosion, ignition, or pressure buildup).

Staging involves a trade-off between the increased hazards associated with drum movement and the decreased hazards associated with the enhanced organization and accessibility of waste materials.

The establishment of the staging area is the first step in the process. The staging area will be in the exclusion zone, will be located and designed to minimize the amount of drum or container movement, will be provided with adequate access and egress routes, and will be well away from all nonessential personnel, other operations, and hazardous, flammable, or combustible materials. Drums and containers within the staging area will be kept to the minimum number necessary to identify and classify them safely and prepare them for transport. Bulk storage of drums will only be permitted once the contents have been thoroughly characterized.

The number of staging areas will depend on site-specific circumstances such as the scope of the operation, the accessibility of drums in their original positions, and the expected hazards. The extent of staging must be determined individually for each site, and should always be kept to a minimum. The most staging areas a site should have is five. These areas can include:

1. Initial Staging Area. The area where drums are organized according to type, size, and suspected contents and are stored prior to sampling.

2. Opening Area. The area where drums are opened, sampled, and resealed. This area will be located a safe distance from the original waste disposal or storage site and from all staging areas to prevent a chain reaction in case of fire or explosion.

3. Sampling Area. During large-scale remedial or emergency tasks, a sampling area, set up at some distance from the opening area, will be used to minimize the number of personnel in the opening area in the event of an explosion.

4. Second Staging Area. Also known as a holding area, this is where drums are temporarily stored after sampling, pending characterization of their contents. **Unsealed drums with unknown contents will not be placed in the second staging area in case they contain incompatible materials.** Either the contents of the drums will be removed or the drum will be overpacked.

5. Final Staging Area. Also known as a bulking area where substances that have been characterized are bulked for transport to treatment or disposal facilities. If a final staging area is warranted, it will be designed in the following manner:

   - The final staging area will be located as close as possible to the site exits.
   - The area will be graded and covered with plastic sheeting.
   - A dike will be installed around the entire area.
   - Drums will be segregated according to their basic chemical categories (e.g., acids, heavy metals, and pesticides). Separate areas will be constructed for each of the waste types present to preclude the possibility of intermingling incompatible chemicals when bulking.

In all staging areas, drums will be staged two wide with two rows per area. These rows will be spaced 7 to 8 feet apart to enable movement of drum handling equipment.

S.7 BULKING

For efficient transportation, bulking of chemicals might be desirable. This involves mixing together and placing chemicals in large containers such as tanks or vacuum trucks. Bulking will be done only after thorough characterization of the waste by trained and experienced personnel. Initial characterization to determine general classifications (e.g., auto-reactives, water reactives, inorganic acids, organic acids, heavy metals, pesticides, cyanides, inorganic oxidizers, and organic oxidizers) may not be enough. In most cases, additional sampling and analysis to further characterize the wastes, and compatibility tests will have to be conducted. Bulking is performed in the final staging area using the following procedures:

- Inspect each tank trailer and remove any residual materials from it prior to transferring any bulked materials. This will prevent reactions between incompatible chemicals.

- Use pumps that are properly rated and that have a safety relief valve with a splash shield to move hazardous liquids. Make sure the pump hoses, casings, fittings, and gaskets are compatible with the material being pumped.

- Before beginning work, inspect hose lines to ensure that all lines, fittings, and valves are intact with no weak spots.

- Take special precautions when handling hoses as they often contain residual material that can splash or spill on the personnel operating the hoses. Protect personnel against accidental splashing. Protect lines from vehicle and pedestrian traffic.

- Store flammable liquids in approved containers.

S.8 Shipment

The contents of all drums and containers will be identified and classified prior to packaging for shipment. The shipment and transportation of drums or bulked material will be done in accordance with applicable DOT and USEPA regulations. The following procedures will be used when shipping the hazardous materials to a treatment, storage, or disposal facility:

- The final staging (bulking) area will be situated as close a possible to the site exit.

- A circulation plan will be prepared that will minimize conflict between the cleanup teams and waste haulers. Traffic signs, lights, and other control devices will be used when necessary.

- Adequate areas for on-site and hauling vehicles to turn around will be provided.

- Waste-hauling vehicles will be kept in a safe area until ready for loading with drivers remaining in the cab. The time that the drivers are in the hazardous area will be minimized.

- Ensure that the driver is outfitted with appropriate protective equipment.

- All drums will be tightly sealed before loading. Leaking or deteriorated drums will be overpacked. Drums will be loaded one high and secured to prevent shifting during transport.

- Bulk solids will be kept several inches below the top of the truck container. Loads will be covered with a layer of clean soil, foam, and/or tarp and secured to prevent shifting or release during transport.

- Decontaminate vehicle tires prior to leaving the site to ensure that contamination is not carried onto public roads.

S.9 TANKS AND VAULTS

Tanks and vaults are often found on hazardous waste sites. When opening and sampling a tank or vault, the same general procedures will be used as for opening a drum. These procedures include:

- Venting excess pressure from the tank or vault if volatile substances are stored. A deflecting shield will be placed between workers and the opening to protect workers from direct contact with contamination being forced out by pressure when the tank is opened.

- Manholes and access portals will be guarded to prevent unauthorized or accidental entry.

- The contents will be identified and characterized through sampling and analysis. If characterization indicates that the contents can be moved safely with available equipment, vacuum them into a trailer for transportation to a disposal or recycling facility.
- The tank or vault will be emptied and decontaminated before disposal.
- If tank entry is necessary, the confined space entry procedures found in Appendix I will be followed.

APPENDIX T HEARING CONSERVATION PROGRAM

T HEARING CONSERVATION PROGRAM

T.1 INTRODUCTION

The human ear is an extremely delicate, highly sensitive instrument. It has a frequency range of sensitivity from 20 to 20,000 Hertz (Hz). It is so sensitive that in a very quiet environment, it can hear a pin drop; yet it can withstand sounds that are powerful enough to set the entire body into vibration.

Unfortunately, ears and their remarkable hearing sensitivity are usually taken for granted until there is a problem or a loss of hearing. Daily, our ears are exposed to loud sounds, at home, at work, and at play. Too much exposure to certain sounds at too loud a level can damage the ear, initially causing a temporary threshold shift (temporary hearing loss), which later can become permanent. Often, the hearing loss is accompanied by intermittent or constant tinnitus (ringing in the ears), which can be extremely annoying.

Hearing loss is either conductive (affecting the outer or middle ear) or sensoneural (affecting the inner ear). A hearing loss due to noise exposure is primarily sensoneural and affects the high frequency sounds first, causing the person to have difficulty understanding what is heard. Sensoneural hearing loss affects clarity so that an individual would, for instance, have difficulty discriminating between 'shop' and 'stop'. If the hearing loss increases, the understanding difficulties become worse, often resulting in immeasurable social, psychological, and emotional problems. Not only does the noise-induced hearing loss create problems for the individual with the loss, it also creates problems for his or her family, friends, coworkers, and employer. A noise- induced (sensoneural) hearing loss cannot be corrected through any type of medical or surgical intervention. It can only be helped, to a certain degree, through the use of hearing aids to amplify sound.

To protect employees' hearing while at work, ABB-ES has developed a Hearing Conservation Program that covers all employees exposed to a time-weighted average (TWA) noise levels of 85 decibels, A scale (dBA), or greater, and consists of the following components:

- Noise assessment
- Hearing testing

- Hearing protection
- Education and training
- Recordkeeping

Note: An estimation of 85 decibels (dB) (or greater) can be made if a person standing in a noisy environment must raise their voice above background levels to be heard by another person standing 2 feet away.

T.2 Noise Exposure Determination

Noise, which is defined as unwanted sound, is the sensation experienced when variations in pressure above and below the ambient atmospheric pressure strike the ear. These pressure fluctuations vary in intensity, harmonic content, frequency, and direction. Because the ear can detect such a wide pressure range (3×10^{-9} psi [threshold of hearing] to 2.5×10^{-2} psi [threshold of pain]), a logarithmic scale is commonly used to describe the pressure with each unit of the scale called a decibel. Because it is a logarithmic scale, increasing the noise levels by 6 dB in actuality doubles the loudness of the noise.

Table T-1 lists the OSHA permissible exposure limits (PELs) for noise which are based on the dB the worker is exposed to and assigns an allowed duration.

TABLE T-1 OSHA PERMISSIBLE EXPOSURE LIMITS

SOUND LEVEL (dBA)	ALLOWED DURATION (T)	PERCENT NOISE DOSE
80	32 Hours	25%
85	16 Hours	50%
90	8 Hours	100%
92	6 Hours	131%
95	4 Hours	200%
97	3 Hours	261%

SOUND LEVEL (dBA)	ALLOWED DURATION (T)	PERCENT NOISE DOSE
100	2 Hours	400%
105	1 Hour	800%
110	30 Minutes	1,600%
115	15 Minutes	3,200%

Any ABB-ES area or worksite where there is reason to believe employees are being exposed to levels above 85 dBA on a TWA will be monitored with a sound level meter or noise dosimeter. Sound levels will be measured in the workers' hearing zone with a Sound Level Meter meeting the minimum requirements of the American National Standard Specification for Sound Level Meters, S1.4 (1971) Type S2A, and set to use the A-weighted network with slow meter response. If a worker is exposed to variable noise levels over a workday, a noise dose calculation will be conducted to determine the 8-hour, TWA which is then compared to Table H-1. The following formula is used to calculate the percentage noise dose:

$$\frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} + \ldots + \frac{C_n}{T_n} \times 100 = \text{PERCENT NOISE DOSE}$$

C = Actual Exposure Time
T = Allowed Exposure Time

A noise dose of 50 percent equates to an average 8-hour, TWA exposure of 85 dBA. This would require the employees to be enrolled in the ABB-ES Hearing Conservation Program. A noise dose of 100 percent equates to an 8-hour, TWA exposure of 90 dBA, the Occupational Safety and Health Administration (OSHA) PEL for an 8-hour day. Any noise doses above 100 percent require mandatory engineering controls, administrative controls, or hearing protection. Because some workers can experience hearing loss at levels between 85 and 90 dBA, noise levels should be reduced or attenuated, through the use of hearing protectors, to below 85 dBA.

Criteria for determining whether an area requires monitoring include:

- An area with a past record of excessive noise
- Employee complaints of discomfort or temporary hearing loss
- Inability to converse easily, without shouting, at a distance of 2 feet

Employees who work in any area meeting the above criteria or in an area where they are concerned about the noise levels should contact the HSM to request a noise survey.

T.2.1 Engineering Controls

If the noise survey should determine that levels exceed 85 dBA, TWA, controls will be implemented wherever possible. The most satisfactory method of noise exposure control are engineering controls that reduce noise levels at their source. Possible engineering controls include:

- Process modification
- Equipment changes (redesign or proper maintenance)
- Automation
- Containment of noise source
- Shielding or isolation of operators

As engineering controls will often be impossible or impractical at hazardous waste sites, administrative controls or hearing protection may be the only feasible alternatives to choose from.

T.2.2 Administrative Controls

In most field applications, engineering controls will not solve the noise problem. If that is the case, then administrative controls must be considered. Administrative controls that may be possible at a site include:

- Combine and limit noisy operations to specific periods during the workday.

- Provide quiet periods throughout the day and quiet environments. There is considerable evidence that frequent, short breaks from the noise reduce threshold shift.

- Limit each worker's exposure to only his/her own noise.

- Rotate employees in and out of the noisy environment.

If TWA levels are still not reduced to below accepted levels, then audiometric testing and hearing protection are required.

T.3 AUDIOMETRIC TESTING

All employees exposed or potentially exposed to a TWA of 85 dBA must be included in the Hearing Conservation Program, which includes an initial baseline audiogram and subsequent annual audiograms. All audiograms will be conducted by a certified audiologist, otolaryngologist, or other physician, by a person who is certified by the Council of Accreditation in Occupational Hearing Conservation, or by an audiometric technician who has satisfactorily demonstrated competence in administering audiometric examinations. Note: Audiometric testing is currently being provided as part of the annual health monitoring physical for all employees in the program.

The audiometer is an electronic audio signal generator that produces pure tones (the simplest form of sound) at various frequencies and intensities and is used to test human hearing. It produces frequencies of 500 to 8,000 Hz and the intensity levels are measured in dB. The ability of the employee to hear the frequencies at the varying intensity levels is measured for each ear and recorded on a graph or audiogram. The lowest intensity level, or threshold is recorded for the following frequencies (500, 1,000, 2,000, 3,000, 4,000, 6,000, and 8,000 Hz). Note: the 8,000 Hz frequency is not required by OSHA, but helps distinguish the difference between noise-induced hearing loss and presbycusis (hearing loss due to aging).

Baseline audiograms are obtained for all employees exposed to TWA levels at or above 85 dBA. The testing to establish the baseline must be preceded by at least 14 hours without exposure to workplace noise. All subsequent audiograms are then compared to the initial baseline audiogram to determine if a "Standard Threshold

Shift" is present. A Standard Threshold Shift is defined as change in the hearing threshold relative to the baseline audiogram of an average of 10 dB or more at 2,000, 3,000, and 4,000 Hz in either ear. OSHA defines hearing impairment (often compensable under workers compensation) as a 25 dB or greater permanent shift at 2,000, 3,000, and 4,000 Hz, in either ear, when compared to the baseline.

T.4 HEARING PROTECTION

ABB-ES' policy is to make hearing protection available to all employees exposed to 85 dBA, TWA of noise or greater. The use of hearing protection is mandatory if:

- levels are above 90 dBA; or
- levels are above 85 dBA and the employee has not had an audiogram; or
- levels are above 85 dBA and the employee's audiogram shows a standard threshold shift.

Various types of protection are available and include ear plugs, ear caps, and ear muffs. Employees are encouraged to select the most comfortable type for them to use. All types provide adequate attenuation (noise reduction) for typical hazardous waste site work, typically between 13 and 29 dB, with ear muffs generally providing greater attenuation than ear plugs, and ear caps providing the least attenuation of all.

Each manufacturer is required to provide noise reduction ratings (NNR) for their device (the amount of attenuation provided when the device is worn). The NNR should be referred to when selecting the device needed to reduce the noise levels to below 85 dBA. For instance, if a worker is exposed to a noise source producing 95 dBA, a hearing protection device with a NNR of at least 10 (which would attenuate the noise levels at least 10 dBA) would be required.

The effectiveness of hearing protection devices depends primarily on the employee. The employee must actually use the device faithfully and position it correctly in or over the ear. The following are some factors that can affect the way sound energy is transmitted through or around the device:

- Seal Leaks. Small leaks in the seal between the protector and the skin can significantly reduce the low frequency attenuation. As air leaks become greater, attenuation becomes reduced in all frequencies (e.g., wearing glasses and ear muffs).

- Material Leaks. Leaks that permit transmission of sound directly through the material of the device.

- Device Vibrations. Vibration of the hearing protection device itself caused by exposure to external sound energy.

- Bone Conduction. The level of sound reaching the inner ear by bone conduction should be about 50 dB below the level of air conduction; therefore, a perfect hearing protection device worn in or over the ear cannot provide more than 50 dB reduction below the level of air conduction.

Ear plugs, ear caps, and ear muffs each has advantages and disadvantages.

Ear Plugs seal the ear canal and prevent noise from reaching delicate parts of the ear. Some ear plugs come in standard sizes; others are individually moldable; while others are custom fitted to the exact shape of your ear. Size is of critical importance with reusable, permanent ear plugs because ear canals are different, even in the same person. Ear plugs are small, inexpensive, portable, and comfortable in hot weather. Their major disadvantages are that they can be hard to fit if reusable and they can introduce dirt into the ear canal.

Canal Caps are soft pads on a headband, worn under the chin, that seal the entrance to the ear canal without actually entering it. Canal caps are comfortable, cool, and lightweight, and provide the benefit of allowing placement without touching the pad or skin. A potential problem, however, is that as a snug fit is essential, they don't always effectively seal the ear canal. Canal Caps are best used around noise levels up to around 95 dBA.

Ear Muffs have three basic parts - a headband, ear cups, and ear cushions. To be effective, the cups must fit snugly. Therefore, ear muffs will probably not fit correctly if glasses, safety glasses, or a possibly a respirator is used. One size usually fits everyone. The major disadvantages with ear muffs are their bulk; discomfort in hot weather; and possible difficulty in wearing other personal protective equipment.

If the hearing protection device must be removed frequently, ear muffs or ear caps may be preferable. Reusable ear plugs, ear caps, and ear muffs must be kept clean and washed before each use. It is recommended that if ear plugs are worn, only the disposable type be used. The choice of the preferable device is up to the individual, the noise levels, and work being conducted. As long as the selected device has adequate attenuation for the noise levels, any of the three devices are acceptable, and if high noise levels are encountered, may even be used in combination.

T.5 Education and Training

ABB-ES will provide annual education and training programs for all employees included in the Hearing Conservation Program. This training will include:

- Proper Use, Care, and Attenuation Characteristics of Hearing Protection Devices
- The Effects of Noise on Humans
- The Purpose of Audiometric Testing

The above training will be provided during the annual Refresher/Supervisory training courses.

T.6 Recordkeeping

For two years, ABB-ES will maintain accurate records of noise exposure assessments for all employees who may be exposed to a TWA of 85 dBA or greater. In addition, ABB-ES will maintain, for the duration of employment plus 30 years, the results of the audiometric tests as part of the employees medical surveillance records (see Section 2.0).

APPENDIX U RADIATION PROTECTION PROGRAM

U RADIATION PROTECTION PROGRAM

U.1 INTRODUCTION

The Radiation Protection Program addresses the work practices which personnel must follow in order to be protected from exposure to radiological hazards. Work practices must provide the protection necessary to keep the exposure levels as low as reasonably achievable (ALARA). Appendix U, Radiation Protection program includes the following items: types of radiation, general work practices, general area and personnel monitoring, bioassay program, environmental monitoring, sample collection and transportation, health and safety plan, training requirements, safety equipment and clothing, respiratory protection, and instrumentation.

The Radiation Protection program sets out procedures to protect workers from radiological hazards. The extent of the Radiation Protection program depends on the amount of contamination present above natural background radiation. At sites, where information cannot rule out the presence of radioactive material, monitoring with direct reading instruments for hazardous levels of ionizing radiation is necessary. Radiation monitoring is required using a Radiation Monitor 4 to measure radiation levels and dosimeter badges for personnel exposure. However, if a site has known contamination, a health physicist must give expertise in establishing the Radiation Protection program. The next section gives an overview of radiation hazards followed by a description of general work practices at potentially contaminated radioactive material sites.

U.2 TYPES OF RADIATION AND ASSOCIATED HAZARDS

There are five types of radiation. At hazardous waste sites, the following three types and their hazards may be encountered:

(1) An alpha particle is emitted from the nucleus of heavy atoms. It has a mass of 4 atomic mass units (amu): 2 protons and 2 neutrons. The slow moving alpha particles carry a positive charge. They cannot penetrate a piece of paper or skin but are very dangerous when substances emitting them are ingested or inhaled. Alpha particles present an internal hazard. An internal

hazard causes damage inside the body and can occur through injection, inhalation, or absorption. Any particles inhaled will ionize living tissue.

(2) A beta particle is a charged particle emitted from the nucleus of the atom. It has a low mass and a (+) or (-) charge. It travels at one-tenth the speed of light, traveling faster than an alpha particle. Beta particles can penetrate paper or several millimeters of skin. Because of its smaller size and charge, beta particles have a lower probability of interaction with electrons, and therefore a greater ability to penetrate living tissue. Beta particles present both an internal and external hazard, although mostly an internal hazard. An external hazard causes damage inside the body from an outside source of radiation. Beta particles absorbed through the skin act in a similar manner as alpha particles. The lenses of the eye are also susceptible. A 1/4 to 1/2-inch shield of plexiglass or lead will shield most beta particles.

(3) Gamma radiation is electromagnetic radiation emitted from the nucleus of an atom. An unstable nucleus can remain unsettled, even after emitting an alpha or beta particle. It will rid itself of the electromagnetic radiation by emitting a gamma ray. A gamma ray is considered a photon with no mass or charge. It travels at the speed of light. Because the gamma ray does not have any charge or mass, there is little interaction with electrons. Therefore, gamma rays will penetrate through material very readily. Because gamma is a penetrating type of radiation, it presents an external hazard. This radiation also presents an internal hazard because gamma rays pass easily into the human body, damaging tissue in the process. An ionizing event occurs inside the body from a source outside the body.

U.3 General Work Practices

Before working in a potentially radioactive-contaminated work area, employees must have a thorough knowledge of the work practices in the site-specific HASP. The Health and Safety Officer (HSO) must consider all the possible hazards when developing the HASP.

U.3.1 General Area and Personal Monitoring

Personnel and general area monitoring strategies have been devised to ensure the identification of areas and work activities for which engineering controls or respiratory protection are required. Monitoring shall be conducted to confirm that the levels of protection provided by engineering controls and by the respiratory protection program are adequate to protect the worker.

U.3.1.1 General Area Monitoring. General area monitoring assesses airborne contaminants in work areas and at the site boundary. Swipe and grab samples are collected to identify contamination on surfaces and equipment. Equipment that is adequate for monitoring needs shall be available, properly calibrated, and controlled. Depending on the operation, surveys shall be performed to determine the following: external radiation exposure levels, airborne concentrations of radioactive material, personnel contamination, surface contamination in work areas, contamination of personal protective equipment, and suitability for release of equipment and material to an unrestricted area.

U.3.1.2 Personal Monitoring. Personnel monitoring methods measure external and internal exposure to radioactive material. The type of personnel monitoring depends on the type of radiation, the type of work to be performed, and the condition of the work site.

The purpose of internal exposure monitoring is to determine whether and to what extent radionuclides have entered the body. Monitoring of radiation workers for internal contamination is necessary only in work situations where radioactive materials may become airborne, have the potential for ingestion, or could be absorbed through the skin. The most effective internal monitoring techniques are bioassay surveillance and air sampling.

U.3.1.2.1 Bioassay Program

Bioassay includes the measurement of radioactive material in the body to evaluate the radiation dose. The type and frequency of bioassay surveillance required for workers on site must be delineated based on the air sampling results, quantity and chemical form of radioactive material, half-life, and detection sensitivity of the instruments.

A bioassay program will only be used when contamination levels are high enough and are readily dispersed into the air causing the radioactive material to be absorbed through the skin, inhaled, or ingested. The amount of contaminant that can be deposited in the body is based on the maximum permissible concentration hours (MPC-H). The MPC-H depends upon the concentration limits for each individual radionuclide listed in 10 CFR 20, Appendix B.

Any time an ABB-ES employee enters a site where there is a potential for radioactive contamination or an unknown hazardous waste site, he or she must be monitored for external radiation exposure by means of personal dosimeters. These personal dosimeters or badges monitor any exposure to penetrating radiation (beta and gamma) and are changed quarterly. Exposure records are kept for total lifetime doses.

Radiation workers may request a copy of their exposure records. Former employees may request a written summary of their exposures or request that the information be forwarded to a subsequent employer.

Respiratory protection is used only if engineering controls and work practices do not adequately protect workers.

U.3.2 Environmental Monitoring

Contaminants of concern may be present in soil; in air as a result of suspension from soil, groundwater, or transient surface water; or bound to existing surfaces.

All work sites will be surveyed for any surface contamination above background levels. As work is being conducted in an area, radiation survey meters will be used to scan personnel and equipment before leaving the work area. Various instruments will be used (i.e., portable radiation survey instruments), typically ratemeters with scintillation detectors, proportional counters, or Geiger-Mueller counters.

Soil and water samples will be screened in more detail to determine the type and amount of radioactive material in the samples. The characterization of the contaminant depends on the capabilities of the instrumentation. A scaler/counter is used for a specified time period to determine the amount of radioactive material in each sample. With unknown contaminants, further analysis is necessary.

U.3.3 Sample Collection and Transportation

When necessary, all samples will be analyzed for any presence of radioactive material before shipment to an environmental laboratory. Any sample over a certain limit of radioactivity is to be considered radioactive material. Federal regulations require that the owner of the material (licensee) is responsible for the shipment of the material. The shipment must be made under the licensee's name. Any facility contracted to perform the analysis of the samples must have a specific state or federal license to receive radioactive material. The facility must be licensed to handle the radionuclide and the quantity that is in the sample.

U.4 HEALTH AND SAFETY PLAN

The Health and Safety Plan (HASP) has been developed to provide the practical health and safety framework for all field operations. The HASP complies with regulations under the Occupational Safety and Health Act, 1910.120.

The HASP for the site shall address radiological hazards and present the guidelines to be followed for all field activities.

The HASP must address the following situations: training, environmental and personal monitoring, equipment collection and transportation of samples, and work practices.

U.5 TRAINING REQUIREMENTS

All site workers shall be trained to work in accordance with 29 CFR 1910.120. If there is radioactive contamination, then site-specific training will include radiological hazards.

Items that may be covered depending on the severity of contamination are as follows:

(1) Introduction
(2) Radiation fundamentals
(3) Types of radiation and their characteristics
(4) Units of measure of radiation.

(5) Radiation exposures from natural, and man-made sources
(6) Biological effects
(7) Radiation effects and risks
(8) Radiation protection fundamentals - time, distance, shielding
(9) Exposure and contamination limits
(10) Monitoring equipment
(11) Radiation protection plans and procedures

U.6 SAFETY EQUIPMENT AND CLOTHING

The safety equipment and clothing used for chemical hazards is capable of safeguarding against radiological hazards.

U.6.1 Respiratory Protection

The level of respiratory protection will be determined from the results of the air monitoring.

U.7 INSTRUMENTATION

There is only one way to detect and measure radiation and that it is through instrumentation. Instruments used in detecting radiation serve various purposes. Therefore, there is a wide variety of instrument types.

Choosing an instrument depends on portability; mechanical ruggedness; ease of use, reading, servicing; ease of decontamination; reliability; and hazardous waste site work conditions and work practices. Choice also depends on the ability to respond to the radiation being measured, measurement sensitivity at the desired level, response time, and energy dependence. Factors that effect radiation instrument readings are counting geometry, dead time, and the type and energy of radiation.

The instrumentation is calibrated in accordance with manufacturer's specifications.

Some instruments that may be used in the field are **radiation survey meters** and **counters**; both have a specific detector for the desired radiation. Detectors are classified in the following categories: gas-filled detectors including ionization chambers, proportional counters, and Geiger-Mueller counters; and scintillation detectors including inorganic crystals, liquid phosphors, and semiconductor devices.

Radiation survey meters are used to detect environmental, personnel, and equipment contamination. **Counters** are used for scanning environmental samples and wipes to determine the presence of any radioactive material in the samples or on surfaces where the wipe was taken. An evaluation of radiological hazards found at the site must be made by a Health Physicist.

UNEXPLODED ORDNANCE PROCEDURE

V UNEXPLODED ORDNANCE PROCEDURE

V.1 INTRODUCTION

Workers who encounter unexploded ordnance (UXO) on military bases risk serious injury, dismemberment, or even death. The safest measure to take to prevent these injuries would be to clear every area that ABB-ES associates work. This, however, is not practical nor in many cases necessary. In order to balance the significant risks with the added time and costs of UXO/EOD clearance, the following procedure has been developed.

V.2 PROCEDURE

When ABB-ES associates or their subcontractors work at military bases (or other sites that could contain ordnance or small arms ammunition), the Project Manager (PM) will review all available information to determine if there is a potential for the ordnance or ammunition to be present at the site. If ABB-ES is to work in an area where ordnance is expected or likely to be, the area must first be cleared by UXO specialists. If work is to be conducted in an area of the base where ordnance is not expected nor likely to be found, work can proceed without clearance. If, however, ordnance is discovered in these areas, work will be halted, workers will clear the area, and the base EOD, weapons department or UXO specialists will be called to remove the item. Work can only proceed once clearance is given.

If ABB-ES is to work in an area that is expected to contain small arms ammunition, the HSO and/or FOL will survey the site prior to the commencement of work. If rounds are found during the clearance or while work is in progress, appropriate parties will be contacted to remove the items.

For the purposes of this policy, small arms ammunition includes rounds that contain propellants (versus explosives) and are for use in arms small enough to be carried by a man.

Under no circumstances will ABB-ES associates or their subcontractors be allowed to touch, move, or in any other manner handle ordnance or small arms ammunition.

DEFINITIONS AND ACRONYMS

ABB-ES	ABB Environmental Services, Inc.
AIDS	Acquired Immunodeficiency Syndrome
ANSI	American National Standards Institute
Atmosphere	Refers to the gases, vapors, mists, fumes, and dusts within a confined space.
Attendant	The individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program
Blanking/Blocking	The absolute closure of a pipe, line, or duct by fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.
Blood	Human blood, human blood components, and products made from human blood.
Bloodborne Pathogens	Pathogenic microorganisms that are present in human blood and can cause disease in humans. These pathogens include but are not limited to, hepatitis B virus (HBV) and human immunodeficiency virus (HIV).
Ceiling Level	The maximum airborne concentration of a toxic agent to which an employee may be exposed for a specified period of time.
CO	carbon monoxide
Combustible Dust	A dust capable of undergoing combustion or burning when subjected to a source of ignition.

Confined Space	A space that is large enough and so configured that an associate can bodily enter and perform assigned work; has limited or restricted means for entry or exit; and is not designed for continuous use. Confined spaces include, but are not limited to, storage tanks, compartments of ships, process vessels, pits, silos, vats, degreasers, reaction vessels, boilers, ventilation and exhaust ducts, sewers, tunnels, underground utility vaults, and pipelines.
Confined Space, Class "A"	A confined space that presents situations that are IDLH. These include, but are not limited to, oxygen deficiency, explosive or flammable atmospheres, and/or concentrations of toxic substances.
Confined Space, Class "B"	A confined space that has the potential for causing injury and illness, if preventive measures are not used, but not IDLH.
Confined Space, Class "C"	A confined space in which the potential hazard would not require any special modification of the work procedure.
Contaminated	The presence or the reasonably anticipated presence of blood or other potentially infectious materials on an item or surface.
Contaminated Laundry	Laundry which has been soiled with blood or other potentially infectious materials or may contain sharps.
Contaminated Sharps	Any contaminated object that can penetrate the skin, including, but no limited to, needles, scalpels, broken glass, broken capillary tubes, and exposed ends of dental wire.

CPR	Cardiopulmonary Resuscitation
Decontamination	The use of physical or chemical means to remove, inactivate, or destroy bloodborne pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or items is rendered safe for handling, use, or disposal.
Double Block and Bleed	The closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.
ECP	Exposure Control Plan
EMR	Environmental Medicine Resources, Inc.
Engineering Controls	Controls that isolate or remove the bloodborne pathogens from the workplace.
Engulfment	The surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.
Entry	The action by which a person passes through an opening into a permit-required confined space. Entry includes ensuring work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.
Entry Supervisor	The person (such as the employer, foreman, or crew chief) responsible for determining if

	acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by 1910.146. (Note: the Entry Supervisor may also serve as the attendant or as an authorized entrant as long as that person is trained and equipped as required for each role he/she/fills.)
Exposure Incident	A specific eye, mouth, other mucous membrane, non-intact skin, or parenteral contact with blood or other potentially infectious materials that results from the performance of an employee's duties.
Handwashing Facilities	Facility providing an adequate supply of running potable water, soap, and single-use towels or hot-air drying machines.
HASP	Health and Safety Plan
HBV	Hepatitis B virus.
HIV	Human immunodeficiency virus.
HSM	Health and Safety Manager
HSO	Health and Safety Officer
HSS	Health and Safety Supervisor
Hot Work	Any work involving burning, welding, riveting, or similar fire-producing operations, as well as work that produces a source of ignition (e.g., drilling, abrasive blasting, and space heating).
IDLH	Immediately Dangerous to Life and Health

Inerting	Displacement of the atmosphere by a nonreactive gas (e.g., nitrogen) to such an extent that the resulting atmosphere is noncombustible.
Isolation	A process whereby the confined space is removed from service and completely protected against the inadvertent release of material by the following: blanking off (skillet type metal blank between flanges), misaligning sections of all lines and pipes, a double block and bleed system, electrical lock-out of all sources of power, and blocking or disconnecting all mechanical linkages.
Lower Explosive Limit	The minimum concentration of a combustible gas or vapor.
(LEL)	Percent in air (usually expressed in percentage by volume at sea level), which will ignite if any ignition source (sufficient ignition energy) is present.
NIOSH	National Institute for Occupational Safety and Health
Occupational Exposure	Reasonably anticipated skin, eye, mucous membrane, or parenteral contact with blood or other potentially infectious materials that may result from performance of an associate's duties.
OSHA	Occupational Safety and Health Administration
Other Potentially Infectious Materials:	1. The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, synovial fluid, pleural fluid, pericardial fluid, peritoneal fluid, amniotic fluid, saliva in dental procedures, and any body fluid that is visibly contaminated with

blood, and all body fluids in situations where it is difficult or impossible to differentiate between body fluids.

2. Any unfixed tissue or organ (other than intact skin) from a human (living or dead).

Oxygen Deficiency — Refers to an atmosphere with a partial pressure of oxygen (PO_2) less than 132- mm Hg. Normal air at sea level contains approximately 21 percent oxygen at a PO_2 of 160-mm Hg. At an altitude of 5,280 feet, normal air contains approximately 21 percent 0_2 at a PO_2 of 132-mm Hg.

Oxygen-enriched Atmosphere — Any oxygen concentration greater than 23.5 percent (PO_2 190-mm Hg) at normal atmospheric pressure.

Parenteral — Piercing mucous membranes or the skin barrier through such events as needlesticks, human bites, cuts, and abrasions.

Permissible Exposure Limit (PEL) — The maximum 8-hour, TWA of any airborne contaminant which an employee may be exposed. At no time shall the exposure level exceed the ceiling concentration for that contaminant, as listed in 29 CFR Part 1910 Subpart Z.

Permit-Required Confined Space — A confined space that has one or more of the following characteristics: 1) contains or has a potential to contain a hazardous atmosphere; 2) contains a material that has the potential for engulfing an entrant; 3) has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-

	section; or 4) contains any other recognized serious safety or health hazard.
Personal Protective Equipment (PPE)	Specialized clothing or equipment worn by an associate for protection against a hazard. General work clothes (e.g., uniforms, pants, shirts, or blouses) not intended to function as protection against a hazard are not considered to be personal protection equipment.
PID	Photoionization Detector
ppm	parts per million
Prohibited Condition	Any condition in a permit space that is not allowed by the permit during the period when entry is authorized.
psi	pounds per square inch
Purging	The method by which gases, vapors, or other airborne impurities are displaced from a confined space.
Regulated Waste	Liquid or semiliquid blood or other potentially infectious materials; contaminated items that would release blood or other potentially infectious materials in a liquid or semiliquid state if compressed; items caked with dried blood or other potentially infectious materials that are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes.
Respirator (Approved)	A device that has met the requirements of 30 CFR Part 11, is designed to protect the wearer from inhalation of harmful atmospheres, and has been approved by the Bureau of Mines and

	NIOSH, and the Mine Safety and Health Administration (formerly, Mining Enforcement and Safety Administration).
SCBA	self-contained breathing apparatus
Source Individual	Any individual, living or dead, whose blood or other potentially infectious materials may be a source of occupational exposure to the employee. Examples include, but are not limited to, hospital and clinic patients, clients in institutions for the developmentally disabled, trauma victims, clients of drug and alcohol treatment facilities, residents of hospices and nursing homes, human remains, and individuals who donate or sell blood or blood components.
Standby Person	A person trained in emergency rescue procedures, assigned to remain outside the confined space and to be in communication with those working inside.
Sterilize	Use of physical or chemical procedures to destroy all microbial life, including highly resistant bacterial endospores.
Threshold Limit Value (TLV)	The maximum 8-hour, TWA of any airborne contaminant to which an employee may be exposed as recommended by the American Conference of Governmental Industrial Hygienists.
TWA	time-weighted average
Universal Precautions	An approach to infection control. According to the concept of Universal Precautions, all human blood and certain human body fluids are treated

as if known to be infectious for HIV, HBV, and other bloodborne pathogens.

Work Practice

Controls that reduce the likelihood of exposure by Controls altering the manner in which a task is performed (e.g., by prohibiting recapping of needles, using a two-handed technique).